Gas Journal

LIGHT - HEAT - POWER - BY-PRODUCTS

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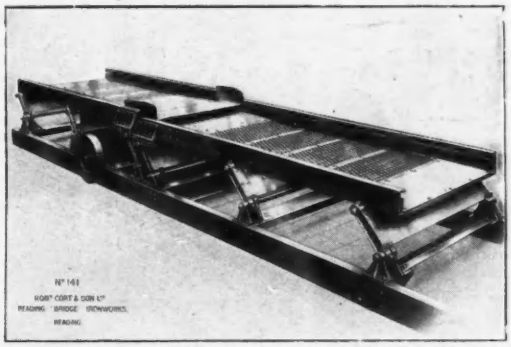

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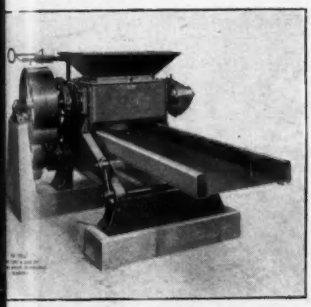
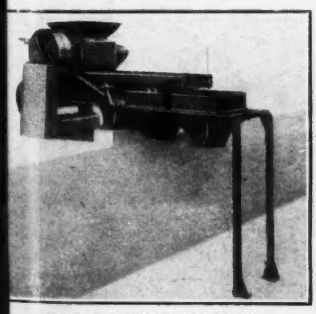
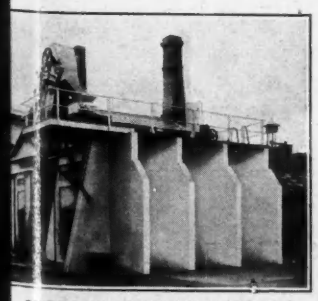


COKE CUTTING MACHINE WITH RECIPROCATING SCREEN



COKE CUTTING MACHINE SCREENING AND BAGGING UNIT



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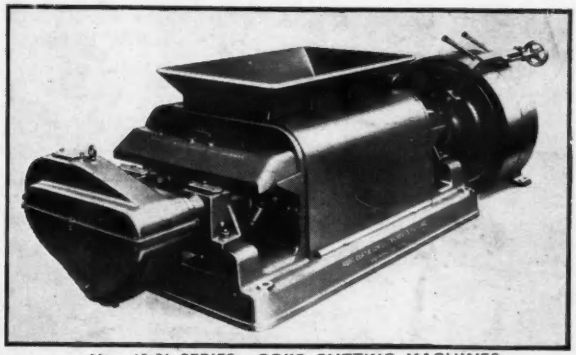

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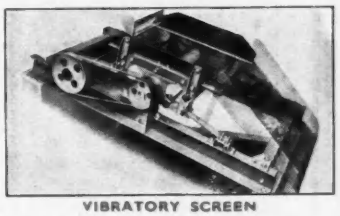

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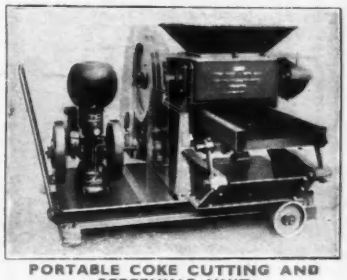

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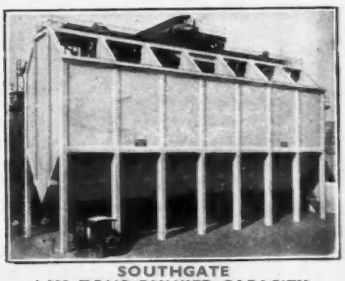

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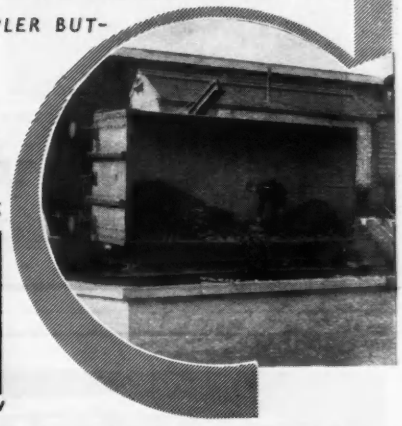

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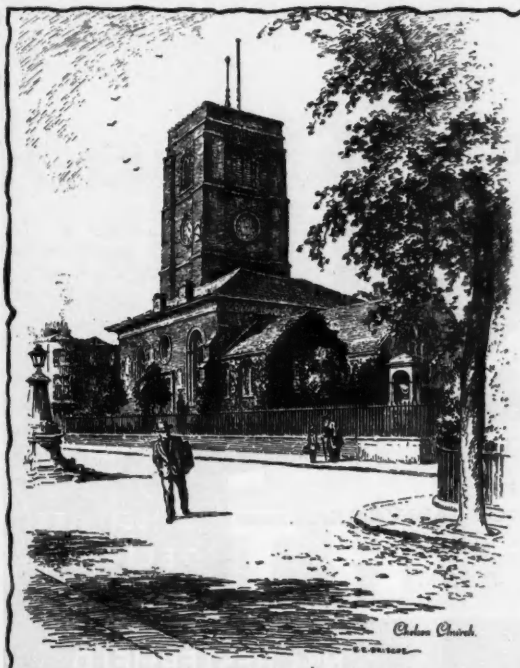

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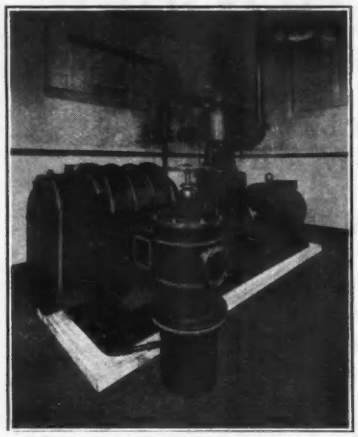

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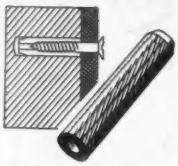

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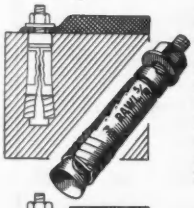

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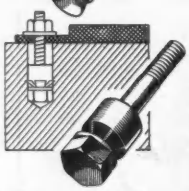

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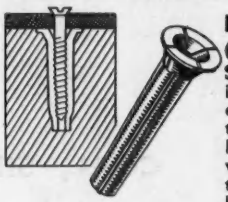

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(Screw Anchors)

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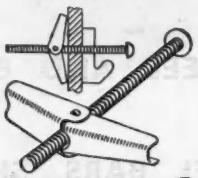

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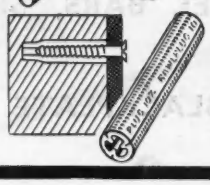

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B311

To Gas Engineers

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2. Oil gas cocks generously with Newbridge Gas cock Oil — but don't dismantle plug if you can possibly avoid it.

3. Never oil any part of the Clock movement. This is an expert's job and harm may easily result.

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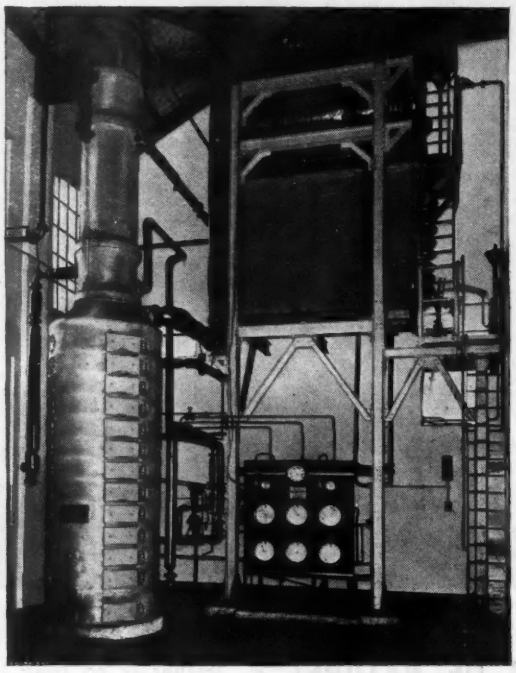

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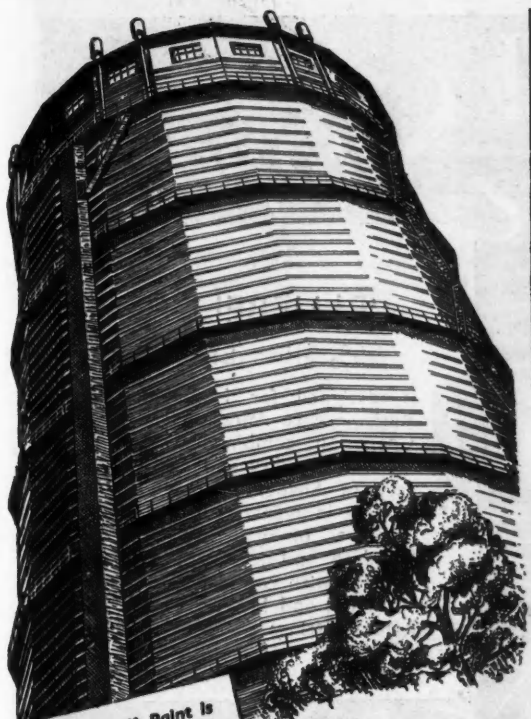

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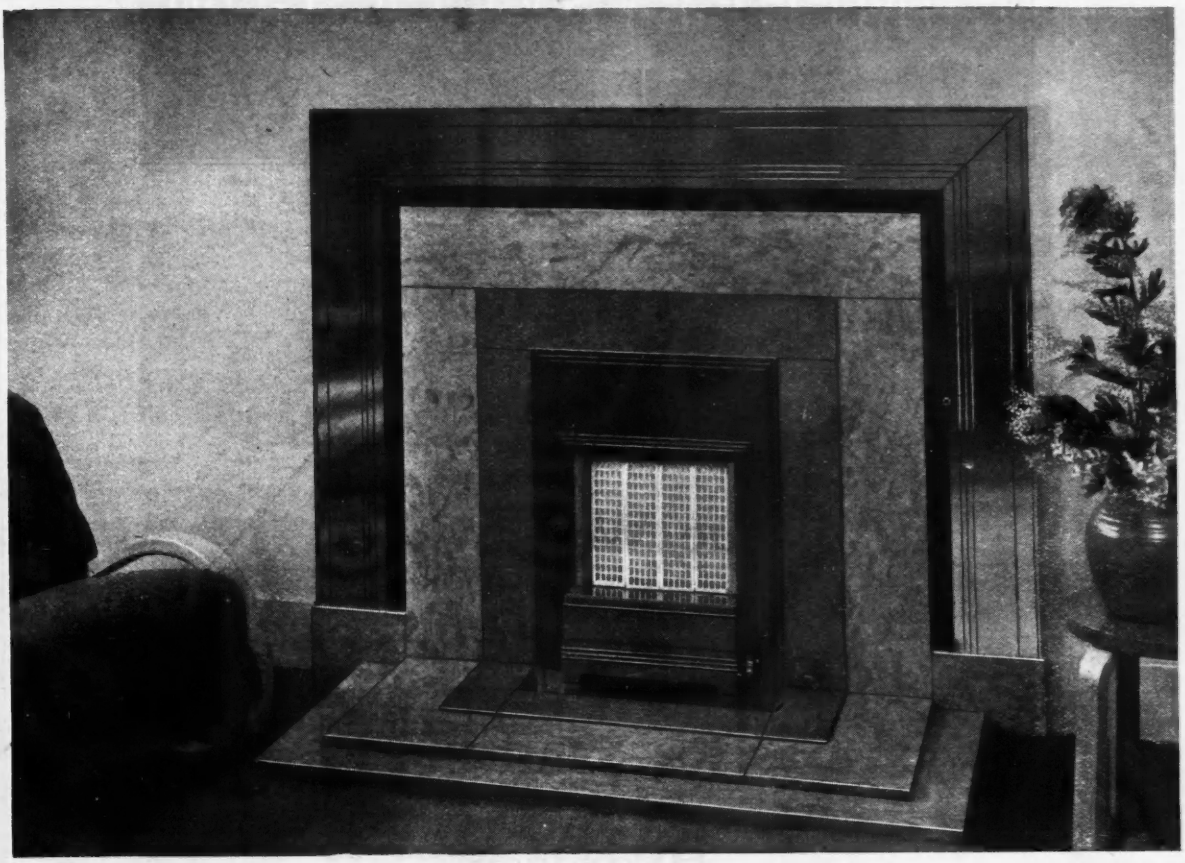

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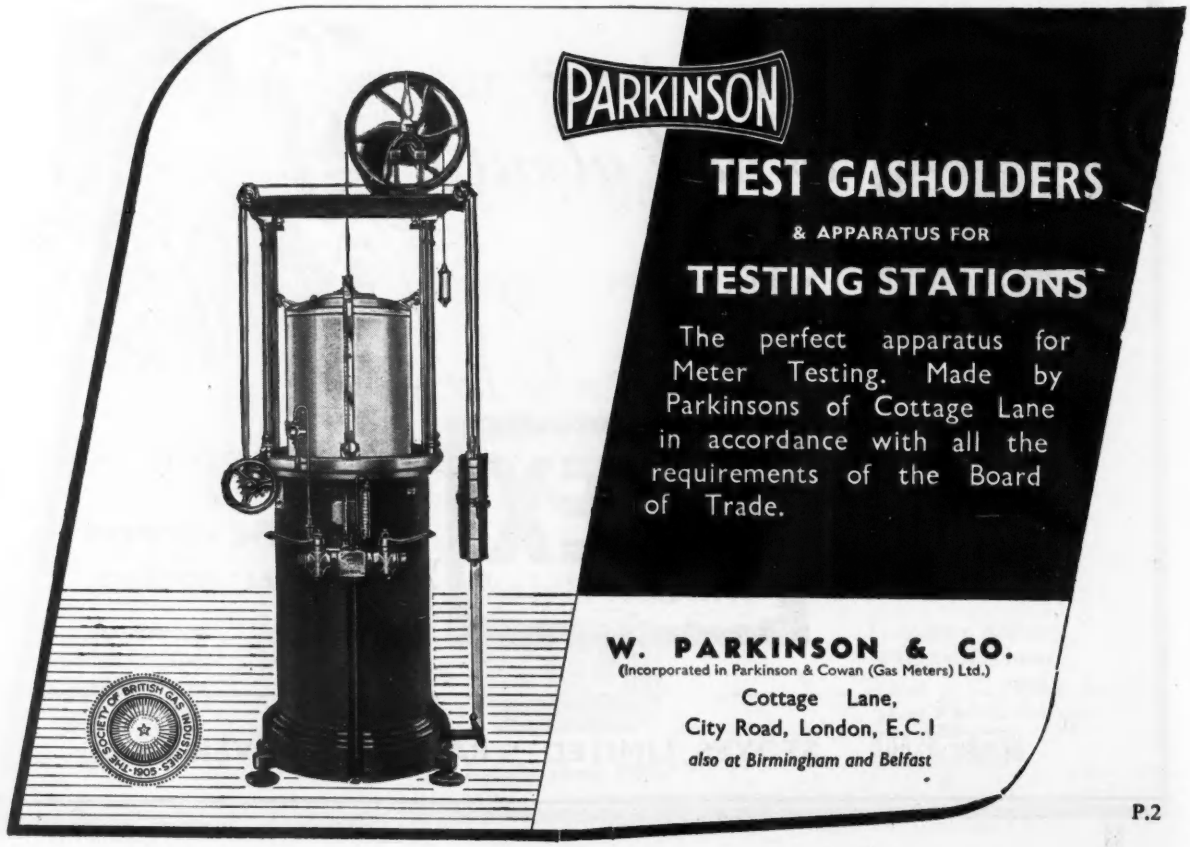
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GAS JOURNAL, APRIL 4, 1945

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EDITORIAL NOTES

COSTS AND PRICES

TOWARDS the end of last year Mr. J. E. Davis, in what we regarded and still look upon as a very important contribution ("JOURNAL" of Dec. 6 and 13, 1944), raised many pertinent questions concerning the meaning and interpretation of gas distribution costs. If we examine the items which commonly go to build up the cost as expressed in the returns of gas undertakings, it is apparent that many of them are not related directly to the number of therms sold. The distribution system of mains and services is designed to meet maximum existing or likely peak demand. Very likely the full capacity of the system is employed for only a small percentage of the time, and this leads to several questions and possibilities, including pressure drop along mains, the economics of installing service governors, the development of bulk transmission, and so on. The problem as a whole, if we are to extend gas service in a big way after the war, calls for more thought and study than have hitherto been devoted to it, and unquestionably as first step demands a great deal more factual information. Compare our own Industry with that of electrical supply. The electricity industry incurs heavier capital charges in respect of both manufacturing and distributing plant per therm of maximum demand than does the Gas Industry. The electricity industry has had to study minutely the effect of diversity and coincidence of demand. A similar study as applied to gas has not yet been made to any appreciable extent by the Gas Industry, the while we are thinking and talking about the installation of gas appliances—cookers, space heaters, water heaters—after the war in terms of millions. To expand gas service with all-round economy, to get full value from the capital invested in gas-making and distributing plant—*i.e.*, to be able to offer gas to the largest number at the lowest price—we need more facts concerning peak hourly demand, the after diversity factor, and the like. We welcome therefore a further contribution on the subject by Mr. Davis in which he carries the matter a stage further, amplifying the points he made earlier. His more detailed approach to the problem found expression in a Paper he gave at the end of March to the Eastern District of the Southern Association—a Paper with which we shall be dealing shortly in the "JOURNAL."

Let it be said at the outset that the Author made no claim to precision in the estimates he put forward. To our mind, however, his contentions do not suffer because of lack of exactitude; in any case, precision, probably unattainable, is unnecessary. The important point is that we do require data of a relative nature to serve as basis for development plans. Let us consider for a moment the meaning of demand characteristics. A gas cooker, "full on," might represent a connected demand of x therm. A wash boiler would represent perhaps y therm, and a gas fire z therm. The connected demand of a consumer with these three appliances would be $x+y+z$ therm. In practice, however, the appliances do not result in an instantaneous demand equal to the connected demand; and even in the unlikely event of all three appliances being in use simultaneously, the hourly demand, with oven heat control and the need for adjusting hotplate burners, would be less than the full connected demand. Then, with a number of consumers connected, the diversity factor comes into play; the maximum demand of, say, 1,000 consumers having gas cookers is appreciably less in practice than 1,000 times the maximum demand of any single consumer. The size of the maximum hourly demand has little direct effect in deciding the capacity of the manufacturing plant, which capacity is decided by the maximum daily demand. Here again diversity between consumers has the effect of reducing total demand below that represented by simple addition of the maxima of all individual users. Obviously a knowledge of the magnitude of these demand figures for various services is necessary in predicting the cost of supplying the services.

Figures for the demand characteristics of the cooking load have the backing of experience, and Mr. Davis, from existing records, put forward figures relating to the area of supply of the South Metropolitan Gas Company. He followed courageously with more tentative estimates regarding the demand characteristics of other domestic loads, water heating and space heating, and this naturally led to consideration of the factor of coincidence or non-coincidence of demand. We are concerned, not with the accuracy of the figures, but with the broad deductions to be drawn from them. From the estimates put forward for the demand characteristics of domestic heat supply, it would seem that the maximum possible extension in the use of gas by the normal domestic consumer would not increase the hourly demand to more than three times its present value. If we accept this, the growing hourly demand might well be accommodated by increased pressure drop in the mains and the provision of service governors.

Mr. Davis concluded his Paper by a suggested classification of costs for gas supply and electricity supply, the purpose being to indicate how, when they are combined with the demand characteristics, they may be used as pointer to the cost of supplying domestic heat services by alternative agencies. What is first demonstrated is the high cost of meeting, by either gas or electricity, those space-heating demands which arise only during the coldest periods of the year; and the Author's figures certainly justify the policy of advocating the use of coke for meeting these demands, while giving the cheapest possible form of domestic heat service. Yet, from the estimates for combined services, a complete gas service is not unreasonably costly. And the conclusion is drawn that the cost of an all-electric service could not be reduced to less than twice that of an equivalent gas service—which, incidentally, reflects the ratio of coal consumed. Finally the Author asked his hearers—to which we would add readers—not to regard his figures as the answer, but as a challenge calling for contradiction or confirmation. Whatever modifications may eventually be found desirable, we do feel that Mr. Davis has usefully cast light on a complex problem the study and solution of which are essential to the successful development of fuel supply on an economic and rational basis in the interests alike of the individual consumer and the nation as a whole.

WHAT ABOUT 6%?

TWENTY years ago we published a "Special Number." It was a "Coke Number," devoted solely to the principal winning papers in a competition suggested to the Editor by Sir Arthur Duckham, who at that time was convinced that an attempt, a serious attempt, should be made to stimulate the Gas Industry into the production and marketing of a solid smokeless fuel which would be acceptable to the man in the home. Allowing for the inevitable time-lag between the conception of a useful idea and its practical application, we do not appear to have made such enormous headway in regard to coke preparation.

"By finding a regular and constant outlet for an improved coke, the value of the coke made should be considerably enhanced, and consequently the price of gas will be reduced, with a subsequent increase in its consumption; and there would appear to be no doubt that, by increasing the use of coke for domestic purposes, there would be a greater use of gas for domestic purposes." This is quoted from the first award in a competition 20 years ago. The validity of the contention holds to-day.

We are not suggesting we have done nothing in the way of preparation of solid smokeless fuel during the past 20 years. Progressive undertakings installed grading plant and so on, charged an appropriately higher price for their coke, and satisfied consumers at the price charged. Gradual improvement was for some years discernible in coke quality as apart from grading, some attention, though all too scanty, being paid to ash content. And then the quality of coals supplied to gas undertakings became haphazard; the coal industry, judging from its deliveries, adopted the "take it or leave it" attitude; carelessness increased in the years immediately before the start of war, and coke quality suffered. We draw a veil over what has happened to the quality of coals supplied to gas undertakings since the war began. We do not know whether a silk purse can be made out of a sow's ear. We do know that a coke satisfactory to the domestic consumer cannot be made from the coals supplied to gas undertakings at the present day.

Fourteen years ago, at a meeting of The Institution of Gas Engineers, Sir Arthur Duckham said: "I do not think we of the Gas Industry have given sufficient attention to the question of coal cleaning. . . . Coal cleaning must come, and it must come rapidly." At the same meeting and during the same discussion—it was a discussion on a Paper by Dr. Lessing in which the Author explained why clean coal was a better material for carbonization than dirty coal—Dr. E. W. Smith contended that the Gas Industry as a whole would not have a smooth time until it became capable of producing consistently, from works both large and small, a coke as good as that available from the coking industry. Time marched on. By 1939 the ash in coke increased because the coal the Gas Industry was able to get had a higher dirt content. We have no analytical laboratory attached to our home, but we have in its "hub," in the "woman's workshop," or whatever we may term the kitchen, a coke boiler the operation and cleaning-out of which make us think that coke to-day is not what it should be.

Fourteen years ago Dr. Lessing produced a lot of figures to demonstrate that if the Gas Industry carbonized clean coal it would save over 2s. a ton of coal carbonized, everything being taken into account. Dr. Lessing may have been optimistic; we ourselves think he was very optimistic, but that fundamentally he was right in insisting that the Gas Industry should insist on being supplied with clean coal. The whole matter was resuscitated on Feb. 28 at a carefully organized meeting of suppliers and users of coal arranged by the Institute of Fuel. We commented on this representative meeting, which was held in Manchester, in our issue of March 7, in which issue we gave a report of the proceedings. We may recall that the Gas Industry placed special emphasis on the necessity for a limitation of the ash content of all coals supplied to it to a maximum of 6%. Coal cleaning, said representatives of the coal industry, would nowadays cost about 1s. 9d. a ton (assessable costs), and that obscure costs—degradation and loss of vend—would amount to 5s. 3d. Total, 7s. a ton for the privilege of being able to get reasonably clean coal. We will not go into detailed argument about these "obscure" costs which constitute such a very great proportion of total cost, but we would ask what steps have been taken during the past month to arrive at a better understanding regarding future coal supplies to the Gas Industry. Is the 6% recommendation of the Gas Industry a mere pleasantry to be recalled as such maybe 14 or even 20 years hence? "Whimsical" or "practical"? Which is the appropriate adjective to apply to the all-day gathering in Manchester and in wartime of the Institute of Fuel?

OPTIMISM WELL FOUNDED

IN the early years after the war, demand for gas appliances of all kinds will outstrip supply—a demand created not only by new housing, but accumulated throughout the war years in respect of existing property. Speedy satisfaction of this dual demand cannot be other than a difficult task, but there are at least good cause and high hopes for satisfaction in the remarks of the Chairman of Radiation Ltd. at the annual meeting last week (already reported in the "JOURNAL," p. 413, issue of March 28). In spite of difficulties during the past year, steps have been taken to ensure that no time will be lost in organizing for the peacetime needs ahead; and Mr. Davies gave assurance that the new needs will be met by the production of equipment embodying the results of improvement in design and performance studied in the war years. He spoke of new gas cookers, new fires, new water heaters—appliances more effective and designed especially with consideration to maintenance, appliances which would reduce running costs—and he referred to developments in Radiation coke-burning apparatus. The firm will renew its activities in the domestic appliance field with a background of long research continuously carried out before the war and which made possible the high-standard equipment of 1939, to which background will be added the experience and knowledge gained and the application of research during the war period. In regard to investigations in the domestic sphere, Mr. Davies mentioned his firm's activities—co-operative activities well known to and appreciated by the Gas Industry—in kitchen design, and we are sure that the hope he expressed that these efforts will serve in the solving of many problems inseparable from housing plans will prove fully justified in the event. We are sure that the optimistic tone of Mr. Davies' speech is well founded.

Rebuilding the Coal Industry

The Technical Advisory Committee on coal-mining, appointed last September by the Minister of Fuel, has now issued its report. It recommends area amalgamation and a central authority with statutory powers, and it states emphatically that natural conditions cannot be blamed for the low productivity of British mines. Conditions are no better in Holland, for instance, but productivity is higher. The biggest technical drawback is found in the inefficiency of British methods of transporting coal from the coal face to the shaft bottom. (U.S.A., 50 tons saleable coal per shift per haulage worker; Great Britain, 5 tons.) "No single operation associated with coal production offers greater scope for improved efficiency." The report attributes the obsolete structure of so many mines to a variety of causes—the cramping influence of private ownership of the coal itself until quite recently; the industry's chronic lack of financial resources, which has discouraged expenditure on long-term improvements; the wide dispersion of the ownership of collieries, which has hampered the most efficient conduct of mining operations in many areas; and the fact that "the employers, as a body, have been prepared neither to accept the principle of the survival of the fittest, nor fully to abandon their traditional individualism," and have too often been obliged or inclined to seek immediate returns to the detriment of efficiency in the long run. It is recommended that ownership of all collieries in each suitable area should be unified. There must be a public authority with effective powers to promote speedy amalgamation. The areas must be determined by geological, geographical, and other technical considerations. The question of how the recommendations are to be carried out was beyond the experts' terms of reference.

Playing Fields as Recruiting Centres

Last June the Southern California Gas Company found itself short of man-power. Accordingly it "hired" 200 young men, including students from more than 30 high schools. The majority of the boys were assigned to maintenance work; others were placed in the machine shops and in other departments. From the experiences gained, the Company's officials concerned with personnel have found that athletes are preferable as summer workers to non-athletes. It was found that the boy who has been a participant in his school's sports activities is "healthier, stronger, and a better all-round physical specimen. Those who played in teams—football, baseball and track, such as relay teams requiring co-ordinated effort—carry the spirit of teamwork into their jobs. Even the boys assigned to digging trenches are inclined

to regard the job foreman somewhat in the nature of a 'coach' and willingly and eagerly accept advice. Boys inculcated with the spirit of teamplay are fine prospects for permanent employees of a large utility organization." Moral? Keep your eye on the boy who has kept his eye on the ball.

Personal

Tribute was paid to the services rendered by Mr. A. W. SMITH during a period of over 50 years with the Birmingham Gas Department, when presentations were made on his relinquishing the office of General Manager and Secretary which he has held for 25 years. The presentations made by the Lord Mayor of Birmingham (Alderman Wiggins-Davies) on behalf of the members of the Birmingham Gas Committee consisted of an illuminated address, a silver salver, and a camera. The Lord Mayor spoke in terms of high praise of the work done by Mr. Smith during the many years he has been with the Corporation. The address gave details of Mr. Smith's rise to the position of General Manager, and went on: "The growth of the Undertaking has been phenomenal; its area of supply has been extended from approximately 75 square miles to 200 square miles; consumers have increased by 160,000 and the output of gas has advanced by approximately 70%; furthermore the works and distribution system have been enlarged and modernized. The Department is now the largest provincial undertaking in the United Kingdom, second only to one of the London Companies, and its prosperity is largely due to Mr. Smith's able and energetic guidance."

* * *

On his retirement on March 31 from the post of Secretary to the Croydon Gas Company, Mr. F. F. WOOD has been elected a Director in the place of the late Sir Ernest Bird.

* * *

A dinner and concert was held at the Parkinson Stove Company on March 22, at which Dr. H. T. ANGUS was the guest of honour, the event being to mark the conclusion of his 17 years' service as Chief Chemist of the Company. Mr. R. J. Rogers, Managing Director, presented Dr. Angus with a wrist watch which had been subscribed for as a farewell gift from the senior employees of the Company, and with an illuminated address giving the names of those associated with the presentation. Dr. Angus leaves the Parkinson Stove Company to take charge of the Development Department of the British Cast Iron Research Association, whose headquarters are at Alvechurch, near Birmingham.

* * *

Sir ERNEST SIMON, Governing Director of the Group of Simon Companies, has been presented with a portrait painted by Mr. T. C. Dugdale, R.A., on the occasion of his 65th birthday. The presentation was made by the Shop Stewards' Convenor, on behalf of the Works and Staffs of the Simon Group of Companies comprising Henry Simon, Ltd., Simon-Carves, Ltd., Henry Simon (Engineering Works), Ltd., Turbine Gears, Ltd., and Tyresoles, Ltd.

* * *

Mr. C. ANDREWS, M.I.Mech.E., has relinquished his post with the United Kingdon Gas Corporation, Ltd., to commence in business on his own account, under the style of Charles Andrews & Sons, Civil and Mechanical Engineers, 14, Meadow Bank, Manchester, 21. He will later have the assistance of his two sons, Lieutenant TREVOR ANDREWS, R.E., B.Sc.Tech. (Hons.), and CHARLES KENNETH ANDREWS, B.Sc.Tech. Both are students of the Institutions of Civil and Mechanical Engineers. Mr. Andrews, senior, has been connected with the Gas Industry for 24 years.

Coal Restrictions for April

The Minister of Fuel and Power has announced that the London coal restriction for April will be the same as for March—*i.e.*, not more than 5 cwt. of coal and Coalite may be supplied without licence to any controlled premises, and no delivery is permitted where the stock exceeds 5 cwt.

The maximum aggregate supply of coke, anthracite, dry steam coal, and manufactured fuels other than Coalite will also be 5 cwt. with a 5 cwt. stock limit.

1945 "Journal" Directory

Page 14. CAMBRIDGE. J. Hunter Rioch, *M.D.*
" 20. CROYDON. W. H. Haddleton, *S.*, *vice* F. F. Wood, retired.
" 22. DROITWICH. G. D. Humphreys, *E. & M.*
" 36. ILKESTON. J. A. Derbyshire, *E.&M.*
" 92. NEWTON-ON-AYR. C. E. N. Freshney, *E.&M.*

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

Wales Juniors

Members of the Wales and Monmouthshire Junior Gas Association met at the works of the Metal Box Company, Ltd., Neath, on March 8. The party, accompanied by the Mayor of Neath, Alderman Hughes, the Chairman of the Gas Committee, Councillor Emanuel, and Mr. W. Clark Jackson, Engineer and Manager of the Neath Corporation Gas Department, was welcomed by Mr. Martin, Manager of the Metal Box Company.

The manufacture of tins and cans was witnessed from the time the iron sheets were unpacked to the point where they were packed in cardboard boxes and railway trucks. Members had an opportunity of inspecting direct gas-fired lacquering ovens, each 125 ft. long, by 8 ft. high and 4 ft. wide, gas-fired drying ovens used for drying liquid rubber composition, continuous automatic gas-heated soldering machines, an installation of high pressure gas-heated soldering irons, a gas-heated infra-red paint-drying tunnel, and an all-gas canteen.

Afterwards the visitors were entertained at tea by the Company, when there were speeches by the Mayor of Neath, the Chairman of the Gas Committee, Mr. W. Clark Jackson, and Mr. Howard, of the Metal Box Company.

A vote of thanks to the firm was proposed by Mr. W. R. Branson, President of the Junior Gas Association, and seconded by Mr. D. W. Rees (Pembroke).

Stoke-on-Trent's Gas Scheme

The Stoke-on-Trent Corporation's new gas scheme was referred to at a recent meeting of the City Council.

Moving the adoption of the Gas Committee's report the Chairman (Alderman A. E. Hewitt) referred to the Ministry of Fuel and Power's authorization of the Corporation's proceeding with the extensions of the Etruria Gas-Works to raise their capacity from the 2 million cu.ft. a day plant at present being erected to 6 millions a day. The report said that labour priority had been granted as from Aug. 1, but Alderman Hewitt asked leave to amend this to April 1, saying it now proved possible to start the work sooner than they thought. It was expected that the work would be finished by 1947 and when complete would double the present capacity of the plant.

Alderman Hewitt added that many enquiries had been made by industries of all kinds—not only pottery—whether there would be enough gas available in the city for new industrial developments. It was gratifying to the Gas Engineer (Mr. J. E. Stanier) to have had this authority given, and to know that he could get on with the job.

The Lord Mayor (Alderman W. H. Kemp) congratulated the Gas Committee on the progressive way in which present and future problems were being tackled.

Diary

April 10.—British Gas Council: Gas Industry House, 2 p.m.
April 10.—National Federation of Gas Coke Associations: General Committee, 10 a.m. Gas Industry House.
April 12.—Industrial Gas Centres Committee: Newcastle-upon-Tyne and Gateshead Gas Company's Offices, 10 a.m.
April 12.—Institute of Fuel: City and Guilds of London Institute, South Kensington, S.W. 7, 2.45 p.m. Address by Dr. E. W. Smith, C.B.E.
April 12.—North British Association of Gas Managers: Spring Meeting, Lesser Town Hall, Johnstone, 10.45 a.m.
April 13.—Institution of Chemical Engineers: Annual Meeting, 11 a.m.; Luncheon, 1 p.m.; Connaught Rooms, W.C. 2.
April 16.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m. Gas Industry House.
April 20.—Manchester District Association of Gas Engineers: Visit to Mirfield.
April 27.—Manchester District Association of Gas Engineers: Annual General Meeting.
May 3.—Southern Association of Gas Engineers and Managers: Grosvenor House, London, 2.30 p.m. Address by A. E. Sylvester.
May 10.—Eastern Counties Gas Engineers' and Managers' Association: Spring Meeting, Grosvenor House, W. 1. Presidential Address of J. Hunter Rioch.
May 14.—Women's Gas Council: Executive Committee, Gas Industry House, 12.45 p.m.

On March 24 the Works of George Wilson Gas Meters, Ltd., entertained a party of 60 wounded soldiers. The canteen was decorated with photographs of the leaders and flags of the United Nations, and entertainment was provided by two concert parties. On leaving, each wounded soldier received a gift.

"So Much Coal has had to be taken from the reserves of the Nottingham Corporation Gas Department that the outlook for next winter is far from rosy," Mr. George Dixon, Gas Engineer and Manager, has stated. "The coal position is still critical. We are still dipping into our reserves, although not heavily. There will have to be every economy if we are to get through next winter without curtailment of gas."

The Synthesis of Methane*

By J. G. KING, O.B.E., D.Sc., Ph.D., Director of the Gas Research Board

ONE section of the pattern of research which has been prepared by the Gas Research Board is concerned with the production of methane by synthesis methods.

You have recently read of the results obtained in one part of this section (F. J. Dent, "GAS JOURNAL," 1944, **244**, 502) which involves the synthesis of methane by the action of hydrogen under pressure upon coal or coke, with the object of preparing a town gas of fairly normal methane content.

A further part of the same section is a programme concerned with the catalytic synthesis of methane from mixtures of carbon monoxide and hydrogen (water gas, " synthesis gas," town gas), and the possible application of these reactions in existing or in new techniques of gas production. The main purpose of this Address is to review the problems concerned in this latter programme and to outline the progress which has been made. A further purpose is to illustrate the methods adopted in a fairly representative Gas Research Board programme and to invite comment upon them. It will be seen that they consist of (i) the fundamental study of the reactions involved, (ii) the study of the influence of physical variables, (iii) the study of the practical difficulties which arise in harnessing the reactions, and the influence of these upon the kinetics of the reactions, and (iv) the development, through more than one stage, of a technical process or application.

It is of special interest that the researches have been a collaborative effort by two bodies. They have been reviewed regularly by a Joint Committee of the Fuel Research Board with the Joint Research Committee of the Gas Research Board and the University of Leeds, and at the University, and work has been carried out at the Fuel Research Station. Much of the progress made has been due to the stimulating effect of independent thought and the use of rather different methods of attack.

For security reasons it has not been possible to publish the details of the work, but detailed papers are in preparation, and will be presented immediately conditions allow.

The Purpose of Methane Production

The importance of methane to the Gas Industry is well recognized; although it is present in town gas only to the extent of about 25%, it provides about half its thermal value. Further, its high calorific value makes it important as an enriching agent.

The method of synthesis for methane production is significant in a number of ways, but the main interest lies in the fact that the gas can thus be produced in high concentration. The following applications show that the research programme is not an isolated one, but is related to many others in the general pattern. Its successful completion is not therefore an end in itself, but depends upon similar progress in the solution of the associated problems, and upon the possibility of changes over a wider field in which all the findings will be utilized in the most economic manner. Finally, scientific achievement, which is the main concern in the present phase, would have to be such that the overall cost of production of gas was reduced, even if the reduction were slight.

Methane synthesis can be used industrially, so far as can be seen at present as:

(i) A means of producing a gas of high methane content (high calorific value) for use as an enriching agent.

(ii) A means of enriching and detoxifying coal gas.

(iii) A means of providing a gas rich in methane which by a process of refrigeration may produce liquid methane for storage, for peak-load insurance, for motor-fuel, or for chemical purposes.

(iv) A means of treatment of low-grade hydrogen or "total gas" to remove carbon monoxide.

(v) A means of stabilizing the combustion characteristics of town gas.

The first two applications do not require explanation. The third involves researches upon refrigeration problems and upon the storage and utilization of liquid methane, as well as upon methane synthesis. The process of refrigeration has been successfully applied in the United States to natural gas which may contain 98% methane. In this country, where the natural sources of gas rich in methane are relatively small (natural gas, methane from coal measures, and sewage gas), synthesis provides the best means of providing in quantity a process gas of high methane content upon which to apply the results of American experience. It should be said at this stage, however, that the research pattern also includes the study of systems for the recovery of methane from less rich gases, including normal coal gas or coke-oven gas. If methane were made available in liquid form in the Gas Industry it could be stored for use in times of peak load distributed in tanks to outlying districts, used for motor transport, or sold to chemical industry as a raw material for the chemical products obtainable from it by oxidation or chlorination.

An example of the fourth application lies in the treatment of the gas rich in hydrogen which is used for the gasification of coal by the G.R.B.-Dent process. Gas made by the Lurgi process would be sufficiently rich in hydrogen for the purpose, but would contain some carbon monoxide whose conversion to methane in an intermediate stage would be profitable.

The fifth suggested use of methane is perhaps too speculative for consideration now. When the exact explanation of the combustion characteristics of coal gas is obtained it may be that it will be desirable to control this property within closer limits in order to permit of the standardization of combustion appliances. It is possible that the control of gas composition by the use of methane-forming catalysts would be one way of predetermining combustion characteristics.

Studies of the Reactions Involved in Methane Synthesis

The first reference to the catalysis of the reactions involved in the synthesis of methane from hydrogen and carbon monoxide is due to Sabatier and Senderens (*Compt. rend.*, 1902, **134**, 514, 680), and arose from the general method of direct hydrogenation evolved by these scientists (*ibid.*, 1900, **132**, 210). Their short Paper, published in March, 1902, described synthesis from either CO or CO_2, using nickel produced by the reduction at 300°C. of nickel oxide. Reaction was stated to begin at 190° to 200°C. with an H_2/CO ratio of 3, and to proceed well at 250°C., the oxygen forming water only, not carbon dioxide. It is interesting to find that it was recorded that the nickel became carbided.

On May 31, 1902, a British Patent (B.P. 12461) was applied for by two British workers, H. S. Elworthy and E. H. Williamson, which is remarkable for its theoretical grasp of the reactions, and for the width of vision shown by the many claims which were made in relation to processes for the manufacture of gas for illuminating, heating, and power purposes. The claims cover the modification of water gas to give mixtures of CO and H_2, or CO_2 and H_2, the addition of hydrogen made by the steam-iron process, and finally the catalysis of a gas mixture over a reduced nickel catalyst at 250° to 350°C. A second patent (B.P. 14333, 1904) claims the treatment of coal gas and other gases also by nickel at 250°C. Both patents pre-date the French patents of Sabatier, which are so frequently quoted in this connexion (F.P. 354621/05, 355900/05, 400656/08), and it seems remarkable that they should have passed unnoticed, and that there was apparently no publication of the researches which it would seem the authors must have carried out.

At this time it was thought that the reactions were:

$$250°C. \quad CO + 3H_2 \rightleftharpoons CH_4 + H_2O \quad \ldots\ldots\ldots 1$$
$$250°C. \quad 2CO + 2H_2 \rightleftharpoons CH_4 + CO_2 \quad \ldots\ldots\ldots 2$$
$$350°C. \quad CO_2 + 4H_2 \rightleftharpoons CH_4 + 2H_2O \quad \ldots\ldots\ldots 3$$
$$CO + H_2O \rightleftharpoons CO_2 + H_2 \quad \ldots\ldots\ldots 4$$

and several attempts were made by other workers to evolve a process which could be applied in the production of town and other gases. Among these were the proposals of Erdman (*J. Gasbeleuchtung*, 1911, **54**, 737), which were the subject of experiment by the Cedford Gas Process Company (*Gas W.*, 1911, **55**, 195). Armstrong and Hilditch (*P. Roy. Soc.*, A, 1923, **103**, 25) also claimed the catalysis by reduced nickel of reaction 2 only, at 250°C.

Progress towards technical application was inhibited, however, by the difficulty of maintaining the catalyst in an active state for a reasonable length of time. The causes of loss of activity were, however, recognized as:

(i) Poisoning by the action of sulphur compounds.

(ii) Cloaking of the catalyst surface by the deposition of carbon presumably by the reaction:

$$2CO \rightleftharpoons CO_2 + C \quad \ldots\ldots\ldots 5$$

(iii) The difficulty of dissipating rapidly the large heat of reaction of (1) 49,000 cals., (2) 59,000 cals. per mol. CH_4.

In the Cedford experiments an attempt was made to avoid the deposition of carbon by using a process gas of H_2/CO ratio = 5, but this limited the methane content of the final gas to about 35%. Chakravarty and Ghosh (*J. Indian Chem. Soc.*, 1925, **2**, 150) claimed that an active-carbon support for the nickel catalyst inhibited reaction 5.

It was not until about 1937, however, that interest in the process was reborn as a result of the success of the researches of Fischer and Tropsch on the synthesis of liquid hydrocarbons. In their early work (*Brennstoff Chem.*, 5 papers between 1923, **4**, 276, and 1928, **9**, 1921) they had postulated as catalysts the finely-divided metals of the iron group, especially cobalt, for use at atmospheric pressure. Avoiding the problem of removing organic sulphur compounds they had brought the process of hydrocarbon synthesis to a stage of development at which it was possible for the Ruhrchemie A.G. to translate it to the manufacturing scale, employing a new process using alkaline iron oxide at 180°C. to 250°C. for the purification of the process gas from organic sulphur compounds (B.P. 452,417), and a reaction vessel specially constructed to facilitate the rapid dissipation of the heat of reaction. The catalyst at this point was reduced CO, promoted with thoria, and supported on kieselguhr (*Brennstoff Chem.*, 1932, **13**, 61).

* Address to the London and Southern District Junior Gas Association.

About this time Sebastian (*Carnegie Inst. Tech., Coal Res. Lab. Contr.* 35, 1936) suggested the use of molybdenum sulphide as a catalyst which would not be poisoned by sulphur compounds. This catalyst was examined at the Fuel Research Station, but Sebastian's results (at atmospheric pressure) were not confirmed. Experiments at higher pressures up to 200 atmospheres (between 400° and 480°C.) did not show sufficiently high catalyst activity to give a reasonably high or sufficiently maintained rate of conversion. The experiments were therefore redirected (King, *Inst. Gas E.*, C.P. 197/80, 1938) towards the examination of nickel or cobalt catalysts of the Fischer type operated at about 350°C. and using gases freed from sulphur. Nickel and cobalt catalysts supported on kieselguhr and coupled with activators such as thoria, copper, chromium, oxide, and magnesia, were found to give in the laboratory a life of upwards of 80 days, during which the methane content of the CO_2-free gas gradually fell from 80 to 30% and averaged 65%. The Report of the Director of Fuel Research for the year ended March 31, 1939, pages 117–123, gives the composition of one useful catalyst as 100 Ni 18 ThO_2 100 kieselguhr. It was also established that poisoning by sulphur compounds was not serious if the sulphur content was controlled to less than 0.1 gr. per 100 cu.ft., and carbon deposition was not serious if the H_2/CO ratio was maintained over 1.5.

During the same period experiments by the staff of the Gas Research Board were being conducted on parallel lines, studying simple methods of manufacture of nickel catalysts, and means for controlling the difficulties associated with carbon deposition and the dissipation of the heat of reaction. Other studies were also extended to the use of high pressures up to 50 atm. and temperatures up to 800°C.

The results of both investigations are being reported at intervals to the Joint Research Committee and to the Joint Committee on Methane Synthesis. Considerable progress has been made during the war years in eliminating the fundamental difficulties in the operation of the process, and in the development of a technique for use on a larger scale.

Theoretical Consideration of the Reactions

The best way to consider the reactions involved is to start with a high H_2/CO ratio, when the main reaction at a low temperature and at atmospheric pressure is—

$$CO + 3H_2 \rightleftharpoons CH_4 + H_2O \quad \ldots\ldots\ldots\ldots 1$$

Under these conditions the water-gas shift reaction must be satisfied:

$$CO + H_2O \rightleftharpoons CO_2 + H_2 \quad \ldots\ldots\ldots\ldots 4$$

If the H_2/CO ratio is reduced, reaction 4 becomes more effective and more CO_2 appears in the final gas. When the ratio reaches unity the combined reaction is equivalent to reaction 2:

$$2CO + 2H_2 \rightleftharpoons CH_4 + CO_2 \quad \ldots\ldots\ldots\ldots 2$$

The effects of temperature and pressure upon these reactions at H_2/CO ratios of 3, 2, and 1 are expressed graphically in figs. 1 and 2.

In fig. 1 it is shown that an H_2/CO ratio of 3 is the optimum condition for reaction 1. As the ratio falls, the water-gas reaction 4 becomes more important, until at a ratio of 1 the results approximate to reaction 2. The effect of increase of temperature is to favour the water-gas reaction 4 at a high ratio and to favour the methane reaction 1 at a low ratio. A constant CO_2/CH_4 ratio independent of the H_2/CO ratio is suggested at a temperature of about 750°C.

The effect of pressure up to 25 atmospheres is zero at 300°C. but reduces the effect of increasing temperature.

In fig. 2 is shown the percentage of methane obtainable in the dry CO_2-free gas over the temperature range 300° to 900°C. At 300°C. and 1 atmosphere pressure the percentage rises from 83 to 98% as the H_2/CO ratio falls from 3 to 1. With increase of temperature the percentage of methane falls until it is less than 10% at 700°C. Increase of pressure moves all the curves to the right without altering their general shape; a gas containing 50% methane is obtained at 500°C. when the pressure is 1 atmosphere and at 700°C. when the pressure is 25 atmospheres.

On the assumption, now justified by our researches, that a catalyst can be developed which is sufficiently active to bring reactions 1 and 4 to completion at a high space velocity, it is possible from figs. 1 and 2

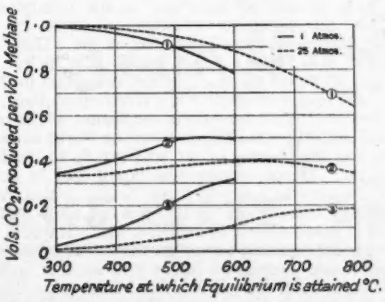

FIG. 1.—*The influence of temperature and pressure on the methane synthesis reactions.*

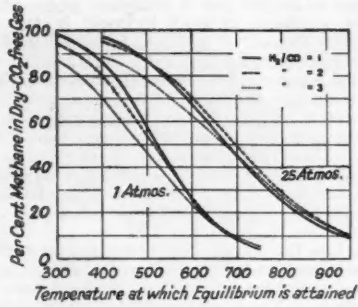

FIG. 2.—*The influence of temperature and pressure on the methane content of the synthesized gas.*

to discuss the conditions necessary in operating a technical process in different circumstances.

If the objective were a gas of high methane content, the most favourable conditions would be low temperature and atmospheric pressure, whatever the H_2/CO ratio. If, however, it were necessary to work at a higher temperature, the methane content could be maintained, and catalyst activity preserved, only by increasing the working pressure. Care must be taken, however, at higher temperature, to prevent deterioration of the catalyst owing to overheating at its surface. Several methods have been adopted to overcome this: An even distribution of the reactant over the surface of the catalyst prevents local overheating; dilution of the reactant with an inert gas slows down reaction at the catalyst surface; and recirculation with the synthesis gas of some of the methane-rich gas produced is successful if the quantities are so controlled as not to affect adversely the equilibrium of the methane reaction 1. Increase of temperature at the catalyst surface, besides causing danger to the catalyst itself, favours reaction 5, with its consequent deposition of carbon on the catalyst.

The deposition of carbon owing to reaction 5 can be suppressed by using a high H_2/CO ratio, which favours reaction 1. To obtain a ratio of 3/1, starting from water gas, however, it may be necessary to treat a proportion of the gas with steam, according to the reaction,

$$H_2 + CO + H_2O \rightleftharpoons CO_2 + 2H_2 \quad \ldots\ldots\ldots 6$$

and to remove the CO_2 by washing under pressure, thus increasing the hydrogen content of the original gas to the required figure. The choice, therefore, may lie between: (1) Removing the carbon dioxide from the synthesis gas obtained as above, in order to obtain a gas of high H_2/CO ratio, which at low temperatures favours reaction 1, in which case there is little to choose between a temperature range of 300°–400°C. at 1 atmosphere, and 400°–500°C. at 25 atmospheres; and (2) using a synthesis gas of low H_2/CO ratio, thus favouring reaction 4 and necessitating the removal of CO_2 from the gas produced. As the process of washing under pressure to remove carbon dioxide is a relatively expensive one, the choice may be dictated by economic considerations.

Having reviewed these theoretical limitations in the application of the reactions of methane synthesis, we can now consider how far the researches have succeeded in promoting the main reactions, and in the development of a technical process in which they are adequately controlled.

Research and Development

As stated above, nickel catalysis have been evolved which can be operated at a high space velocity, and which have an initial activity many times greater than is necessary to carry the main reactions to equilibrium. These have been operated successfully in the laboratory and the reactions have been subjected to close study. In the interests of speed, long period tests to determine the actual life of the catalysts have not been made, but the following results give some indication of what has been achieved:

Temperature, °C.	300	350	350	350	450	650	800
Pressure, atmos.	1	1	5	20	1	20	50
Vols. of gas per vol. cat. per hour	2,000	2,500	2,000	9,500	2,000	7,000	7,000
Methane, % in washed gas	88	85	85	88	55	55	40
Duration of experiment, days	75	100	40	25	60	60	90
Methane, % at end of expt.	85	60	79	50	55	55	55

In the study of catalytic reactions considerable guidance can be obtained from a knowledge of the mechanism of the catalysis. In this case there have been two theories, one involving the formation of unstable oxygenated intermediates (Medsforth, *J.C.S.*, 1923, 1452), and the other, due to Fischer, involving the formation of carbides. The existence of the latter mechanism has been established for a cobalt catalyst by Rideal, Craxford, and Herington (*Trans. Faraday Soc.*, 1939, **35**, 946, 958; *J.C.S.*, 1939, 1604); they consider the initial reaction to be—

$$2CO + CO + H_2 = CO_2C + H_2O \quad \ldots\ldots 7$$

brought about by chemisorption of the carbon monoxide and reduc-

tion in two stages to carbide and to methylene groups attached to the surface. Under conditions in which hydrogen is also chemistorbed CH_4 is immediately formed; if hydrogen is not chemisorbed, as, for example, if the surface is completely covered with carbide, hydrocarbon chains are formed which are split off as methane homologues through the action of molecular hydrogen. Adsorption of hydrogen takes place freely at 160°C. but, as the temperature increases, is gradually prevented by the carbiding of the surface and then, above 230°C., increases again. This explanation shows the need, so far as methane synthesis is concerned, for a catalyst which has strong hydrogenating properties, and for the choice of conditions which favour the chemisorption of hydrogen—*e.g.*, temperatures below 160°C. and over 230°C.

It shows also how the practical conditions for the operation of the catalyst may be chosen to favour the mechanism and to prevent, so far as possible, interference either from side reactions or from the reduction of activity. These conditions can now be defined as:

(i) The exact maintenance of the condition of temperature, pressure, and H_2/CO ratio chosen;
(ii) the control in particular of the temperture of the reaction at the catalyst surface so as to avoid overheating;
(iii) the prevention of reactions which liberate elementary carbon at the catalyst surface.

A sufficient explanation of the mechanism of the reactions which lead to the deposition of carbon has already been found to indicate means of controlling them, (*a*) by adjustment above a minimum of the H_2/CO ratio to a figure depending upon the temperature and pressure, and (*b*) by the addition of steam. A fuller explanation is being sought which, when found, may make possible the complete prevention of carbon formation under the conditions most favourable to methane synthesis. It is apparent that the addition of steam cannot be increased indefinitely, since steam is an end product of the methane reaction and too high a proportion would therefore slow the reaction.

The prevention of overheating is a matter which has an important bearing upon the design of the reaction chamber and upon the thermal efficiency of any process developed. It has been found that overheating causes sintering of the catalyst surface and destruction of the active atoms. Since the catalyst is not a good conductor, the rapid removal of the heat of reaction is a matter of considerable difficulty which has affected all catalytic processes which involve a high exothermic heat of reaction. In the Fischer-Tropsch process of hydrocarbon synthesis at atmospheric pressure, the method adopted was to arrange the catalyst in granular form in a nest of narrow tubes surrounded by water circulated under pressure from a boiler. By controlling the boiler pressure, close control of the water temperature was possible to a fraction of 1°C. The actual temperature variation in the catalyst must, however, be much greater than this, since the diameter of the tubes is about 4 cm., and the equalizing of surface temperature across this distance has to depend upon thermal conductivity through the catalyst to a depth of 2 cm. Further, at the higher temperatures necessary for methane synthesis, a catalyst chamber of this type would require a working fluid other than water. In semi-scale experiments, research workers at the Fuel Research Station have used mercury with some success.

It seems unlikely that a full-scale reaction chamber could be constructed of such a form that the catalyst could be retained in sufficiently thin columns or layers to keep the surface temperature within narrow limits. For the general purpose of controlling strongly exothermic reaction, however, variations of the system have been devised (for example, Dreyfus B.P. 390,846 and 7), involving very narrow tubes or slices, down to $\frac{1}{10}$ in. diameter, surrounded by a cooling fluid, and coated internally with only a thin layer of catalyst. If under these conditions overheating should still develop, the reaction can be further controlled by dilution of the gases with an inert gas. A further variation arranges the catalyst as axial rods within tubes, leaving a clearance for gas flow down to an annulus of 0.2 mm. (Distillers Company, B.P. 466,416, and Potts, B.P. 528,617). Experiments on similar lines have allowed the staff of the Gas Research Board to develop methods by means of which certain catalysts have been kept at full activity for relatively long periods. For security reasons details of these methods cannot be disclosed at present.

The next step in the programme is to apply the knowledge collected to the control of the reaction on a larger scale. This is now being done. Apparatus is being assembled in which a number of gas streams, of 250 cu.ft. per hour each, will be examined concurrently under different conditions. After the successful completion of this step a careful consideration of economics will be necessary before taking the final step towards the development of a pilot plant to operate under the proved conditions.

To see the economic position clearly it will be necessary to introduce all the expedients of efficient heat transfer, with the general aim of having a thermally efficient process, and the particular aim of employing the exothermic heat of reaction, which represents 25% of the thermal value of the methane made. The decision will also depend upon the purpose for which the synthesis process is required; at present it would seem that economic success will require not solely the production of gas rich in methane, but the fitting of the process into a much wider scheme in which other changes are also made in order to make the best use of the new technique.

Presidential Address to the Midland Association

By A. B. BRITTON,

Engineer, Manager, and Secretary, Hinckley Gas Department

I HAVE decided to speak about two problems arising in my Undertaking which had to be solved. Some ten years ago the carbonizing plant consisted of two identical vertical retort houses containing 12 downwardly heated W.D. 5-ton retorts, each plant having a nominal gas output of 1,000,000 cu.ft per day. No 1 Retort House was installed in 1922, and No. 2 Retort House in 1928. There was no screening plant or waste heat boiler coupled with either carbonizing plant. There was an old Humphreys & Glasgow water gas plant of 250,000 cu.ft. per day, manually operated, but generally this was not an economical proposition to work. Coke was sold unscreened. Gas output was growing: it was obvious that in a few years one of the two retort houses would not be large enough to supply the demands. To make up the winter load with water gas was not an economical proposition. It was apparent that a screening plant and waste heat boiler, together with extensions to one of the retort houses, must be installed. The younger plant—No. 2 Retort House—was in better condition than No. 1, though each had worked only approximately six years at the time under consideration. No. 1 Retort House unfortunately has suffered considerably by experimental work in connexion with liquor disposal by evaporation in the producers, the salts, &c., having percolated to the flues of the settings to an alarming extent. The damage had grown appreciably during the time the plant was standing after putting No. 2 House to work. This experiment in liquor disposal was part of the early work of the Liquor Effluents and Ammonia Committee in collaboration with my Undertaking, and has been considered by my Committee as a contribution to the cost of this research. No. 2 retort house was so situated that there was no room either to extend or to add a screening plant in a position that coke could economically be transferred direct from retorts to screen, whereas No. 1 Retort House had room adjacent for the coke plant and stood at a lower figure on the books than No. 2 Retort House.

Our decision was to make No. 1 Plant the principal plant, and first a screening plant was erected in conjunction with No. 1 House, the conveyor altered to circle both houses, and the screen and the coaling system altered to use the storage hoppers in No. 2 House as reception bunkers for the different grades of coal, with adjustable feed deliveries on to a belt conveyor, which eventually delivered *via* a second belt into the conveyor circling No. 1 House at a point after coke had been dumped at the screen. By this arrangement it was possible to blend the coal to give a mixture giving the best carbonizing results and behaviour in the retorts. It was also possible to introduce local non-caking slacks in small percentages with a view to producing a free burning domestic coke. This additional coal storage has eventually proved very valuable. A waste heat boiler was installed, together with one producer, the first of a battery of three.

The old settings were taken out and in their place a setting of 18 lambently heated W.D. retorts of 6½ tons per retort per day with guaranteed output of 2,000,000 cu.ft. per day was installed. This was the first complete installation of lambently heated retorts on a commercial scale that the Company had constructed. The plant has proved itself well worthy of our confidence. It has now worked continuously for 7½ years, and the first general repairs, consisting of the resetting of the upper portion of the retorts, are being carried out during the coming summer, with the exception of two retorts reset last summer in preparation for this work.

Liquor Disposal

For many years it was not possible to dispose of ammoniacal liquor or still effluent in Hinckley *via* the local sewage works, chiefly due to the fact that a minimum of 40% of the flow at the sewage works was composed of dye wastes from local industry which were difficult of treatment in themselves. When gas-works liquors were added containing volumes of higher tar acids and thiocyanates, oxidation at the sewage works was impossible, the outflow leaving the works being similar to blue-black ink with an O.A. figure of anything from 20 or 30 to 50 and 60 according to the amount of gas liquor present. From the extensive investigation made by the Liquor Effluents and Ammonia Sub-Committee of the I.G.E., three things had to be done: (1) Make a liquor or still effluent free from higher tar acids. (2) Cut down the thiocyanates contained in that liquor to a minimum. (3) Install an efficient and economical plant, automatic if possible, to deal with the ammonia in the liquor, as the sewage works could not deal with the total liquor from the works as raw liquor.

There was one source only of tar acid supply to the liquor—from contact with tar. Hence ammoniacal liquor had to be made after the whole of the tar was removed from the gas, which meant that tar had to be removed from the gas while it was hot, allowing the ammonia to go forward in gaseous form in a tar-free gas. It would be necessary to segregate the ammoniacal liquor on the works by using a separate well for retort house circulation liquor and another well for ammoniacal liquor made after the gas was freed from tar. This demanded electrostatic tar precipitation, and a Whessoe W.D. electrostatic tar

* Abridged; delivered March 15.

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precipitator was installed inside No. 1 Retort House as near the gas collecting mains as possible, the gas passing into the treater in the region of 160° to 170°F. The efficiency of this treater is practically 100%. No traces of tar can be detected at the outlet, and the ammoniacal liquor coming away from condensers and ammonia washers is free from higher tar acids. The gas foul mains and treater are well lagged, to cut condensation to a minimum. In addition to ammonia liquor at condensers, a small amount of oil is present, in the region of 1½ to 2 gallons per ton of coal carbonized. This oil somewhat resembles a light creosote and could, if desired, be sold to give an added income for tar.

The reduction of thiocyanate was not such an easy problem. It was assumed that the formation of this product was taking place in the tower scrubbers due to oxidation by air added at the inlet of the exhausters for purifier purposes. It was accordingly decided to install a small air compressor or booster and add the purifier air at the inlet to purifiers, rather than let it be drawn in at inlet to exhausters, and so made available for the oxidation of cyanide to thiocyanate in the ammonia scrubbing plant, especially as this latter consisted of tower scrubbers giving a long time contact. This small alteration proved effective, and reduced the thiocyanate content of the liquor to a proportion that caused no difficulty at the sewage works, at the same time showing a marked improvement in the working of the purifiers.

In regard to item (3) an old sulphate of ammonia plant existed on the works, but was not a paying proposition due to the high price of acid and the high cost of labour for the small quantity of sulphate made. The still was in good condition, and it was decided to convert the plant to one making concentrated liquor which could be sold in a concentrated form and so cut down transport charges. The conversion plant was installed. It is entirely automatic and has worked satisfactorily ever since its installation, concentrating to 22% NH_3 and even higher without difficulty.

While the O.A. of the higher tar acid-free liquor is somewhat higher than the original "polluted" liquor, this higher figure is caused by phenols which are readily oxidized at the sewage works. The flow of still effluent to the sewage works is regulated to give a constant proportion of the total sewage flow. This is arranged automatically by a special instrument by the Lea Recorder Company, Ltd. Prior to the installation of this plant, the liquor from Hinckley had to be transported by rail tank car to Birmingham at a cost to the Undertaking of somewhere in the region of £700 to £800 per year, which to-day would have been more than double this figure. To-day the benefit to the works is in the region of 0·35d. per therm sold.

I feel that the results obtained at Hinckley by taking advantage of the work of the Liquor Effluents and Ammonia Committee is real proof of the value of such collaboration.

The Future

Integration must take place whether the undertakings concerned like it or not. There are, of course, many problems to be settled and many questions that we may be asking ourselves. What size will the grids be, and over what distances can we economically distribute? Who will be the owners? and so on.

The recent formation of the British Gas Council is an advance in thr right direction. It is a sure sign of the desire to get together and manage our affairs under one body.

Coke fuel has of late been much to the forefront as a means of domestic heat supply. What are we doing to stimulate this public demand? Doubtless the various Coke Associations will be well able to do their share, but unless we, in our districts and by our actions, back them up wholeheartedly, then we are not doing all we might for coke. We have had a wonderful opportunity thrust upon us over these last few years by the shortage of coal to show the public what coke can do. I know there are many undertakings that had realized this, and have made a point of supplying in such cases the right size for the particular job, and have been careful to see that the coke has been of good quality and well screened, and yet there are many small works that are selling coke in such cases unscreened and without any regard to quality. Alas, the supply of gas coal has been very much against this policy, and in many instances has seriously affected the quality of the resultant coke, but I look to the day when even this difficulty will be overcome. At this point I feel very tempted to be very critical of the Ministry of Fuel and Power and its economy policy in respect of fuel. Among the umpteen returns that we make there are the quarterly fuel efficiency index figures, and others suggesting their concern for economy through efficiency.

We look forward to having a voice once again in the selection of the coals best suited to our particular plants. The continued price increases we have had to meet, coupled with the falling quality of the fuel, have been a serious matter to our Industry. One hears rumours of the best coal seams at collieries being left for the present in favour of working those of poorer quality, and I have good reason to believe that such cases do exist. Our Industry is not an inconsiderable customer of the coal industry, and due regard should be paid to our requirements, especially when all are finally in the interests of national economy.

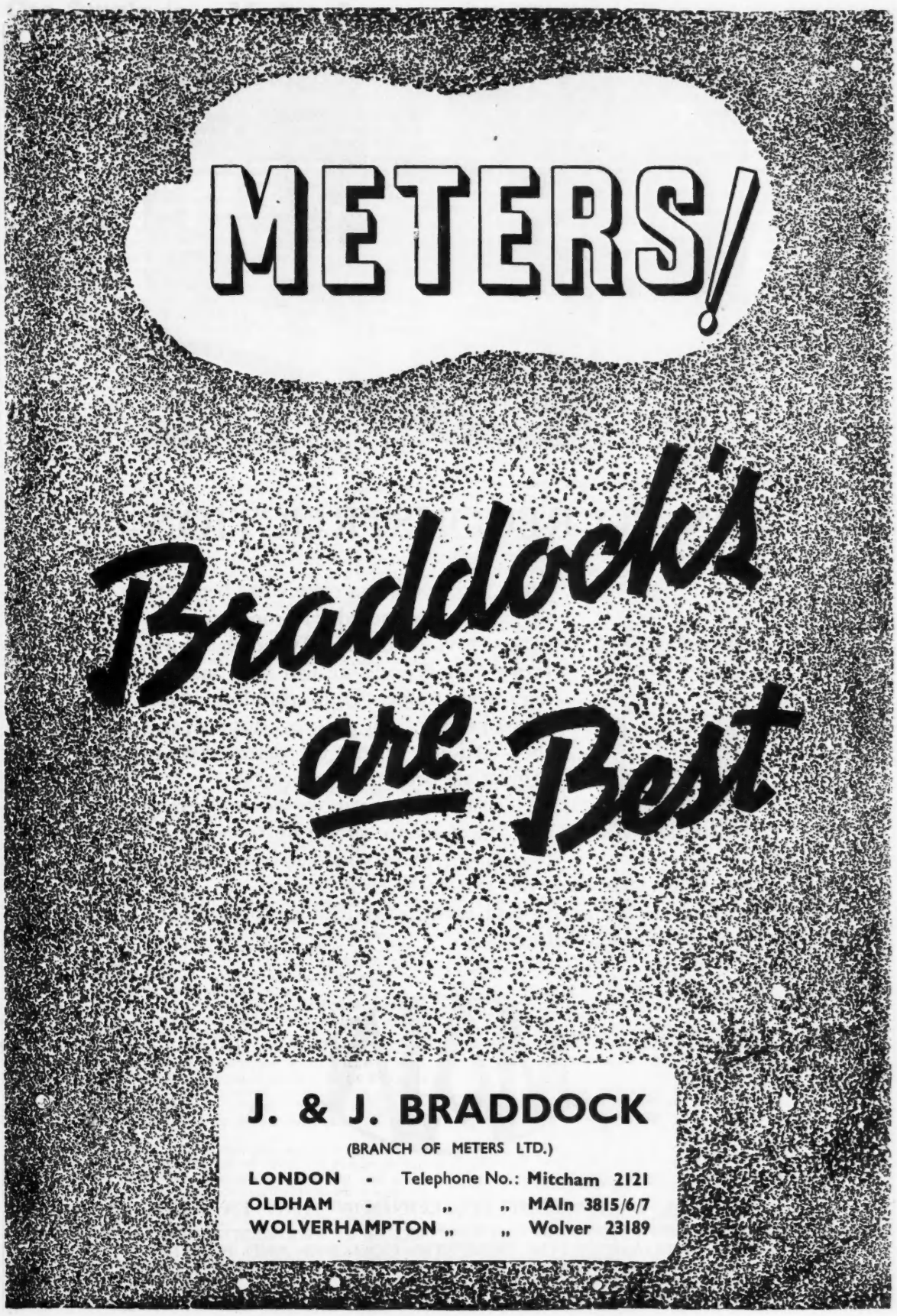
Regarding kitchen planning there are many other directions in which gas can be used to improve post-war domestic life. It seems to me that we are concentrating 90% of our energies on the post-war kitchen to the neglect of other important spheres and loads; and in endeavouring to show what the Gas Industry can do, we are boosting other people's products and designs. I admit that some of the specimen kitchens, especially the equipment, look very attractive when new, but what will they look like after 12 months' use, especially careless use? Pressed steel cupboards and other units of steel in the presence of cooking vapours, and similar units in wood construction that will warp and shrink, are not practicable. I feel that our Industry, in helping to create the demand before the disadvantages found by experience are appreciated by the public, is spending on publicity large sums boosting other industries' products, which in the long run will be of no direct benefit to gas and might well be a disadvantage. I cannot see that the unit-constructed kitchen is a practical proposition. The person who buys a new house or builds a house with the idea of being the occupier certainly can plan his kitchen on the unit system. This is one of the practical cases, and generally the exception. But what about the house which is to be let? Who is going to bear the capital cost and then the maintenance charges necessary to keep the kitchens in good repair? The landlord who buys property as an investment will not generally be prepared to face this burden. Should a landlord be bold enough so to equip his houses, what is going to be the impression gained of the Gas Industry by the tenant who takes over one of these kitchens in which the gas appliances have been neglected by a previous irresponsible tenant? There will be many such cases. Are local authorities going to equip their housing estates like this? The speculative builder has to be persuaded that the fully equipped kitchen is going to be a valuable selling point to him. Having thus persuaded him, he will purchase in the cheapest market. He is not so concerned with how the kitchen will look after, say, a couple of years as he is by the external appearance it will present to a prospective purchaser. This publicity about post-war kitchens is not getting us half as far as we think, and I cannot visualize many such kitchens in my area. I feel that the most popular gas cooker will not be of the unit construction type. There will always be those who will wish to take their cookers with them from one house to another—an argument applying to many appliances, although probably not to the same extent to water heaters and wash coppers.

Hot Water

What about the provision of hot water in the millions of houses that are to be built in the next few years, not to mention conversions? As gas suppliers we should make up our minds as to what we require and let the appliance manufacturers know. Where scale is readily deposited, storage heaters, unless preceded by a water softener, present difficulty. In such cases many undertakings have gone over to the instantaneous type, which has advantages as well as disadvantages, especially in the matter of servicing, not to mention meter and service sizes, although many will be willing to meet this added expense if a satisfactory heater, free from the snags of corrosion and constant cleaning, can be obtained. Ventilation and flues also entail difficulty, and though there are a great number of instantaneous heaters in use, I suggest that in few instances is ventilation perfect under all weather conditions and wind directions. I think the Industry made a bad move when it accepted the non-condensing appliance. I hope in the future to be able to purchase a multipoint instantaneous heater with a closed ventilation circuit, the appliance taking its air for combustion from the outside and delivering its waste products outside to a point somewhat above.

We all know the benefit which would accrue from a sulphur-free or low sulphur content gas. I am often in doubt whether we are doing everything possible to devise a cheap reliable method for its removal. At one time it was a salient point in favour of washing for benzole, and improved methods of benzole extraction were claimed whereby sulphur removal was increased. These are half-hearted attempts at its elimination, and to my knowledge are not up to the 60% efficiency mark. We need something better than this.

Regarding education, you have heard of the formation of the Midland Gas and Allied Industries University Collaboration Committee, with a view to improving the training of our juniors who will have to carry on after us, as well as help to solve many of the post-war problems. Through experience I realize the advantages of a University training. We cannot all have that advantage, and we must not lose sight of the value of the personnel that have received their training in other ways. I am perturbed that entrants to our Industry lack practical training, and this applies specially to the University men. How this lack of practical work can be overcome is difficult to say, but some remedy must be found. It may be that we expect too much of the University graduate, and put him to work as though he were completely trained. It should be remembered that while his University years train him in theory, they also prepare his mind to be readily receptive to those practices that he will only find when coming actually face to face with industry itself. One may have an excellent technical staff, capable of dealing theoretically with every problem or proposition, but how often one sees the practical side left to a foreman or a leading fitter! The latter may be an excellent man in his own way, but cannot combine theory and practice to the best advantage. I agree that our education schemes are proceeding along good and desirable lines, but I want to see our young men more practical.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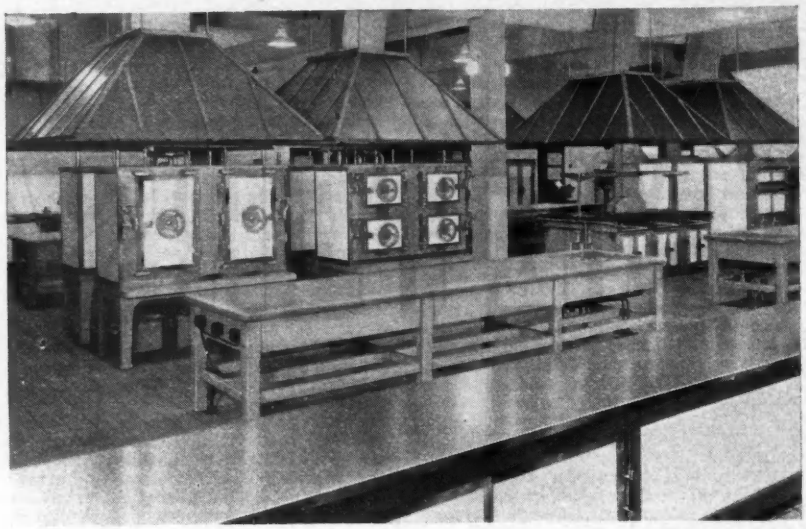

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By J. J. SCOTT,

Engineer and Manager, Cowdenbeath Gas Company, Ltd.

THE problem of gas supply in a mining area is one which has for long exercised the minds of those directly responsible, in an effort to overcome the many difficulties which arise. Such gas undertakings and their officials have a problem of considerable magnitude, and many responsibilities not common to the great majority of undertakings.

As a result of stoppages and changes of approach in coal extraction it is understandable why a whole area may be subject to ground disturbance at different places at different times, and recurring over a number of years. From a long and close association with mining engineers, one has learned to understand to some extent their problems and difficulties, and to be satisfied that it is no wish of theirs to win coal in an erratic manner if it can be avoided.

So long as townships are built upon a coalfield it is their misfortune to suffer the consequences of coal extraction. The major difficulty of gas supply is beyond question that of gas mains, and this may be considered under the following headings:

(1) Continuity of supply.
(2) Nature of damage.
(3) Liabilities arising from damaged pipes.
(4) Unaccounted-for gas.
(5) Financial problems.
(6) Efforts to reduce damage to pipes.

The gas production plant and gasholders are not immune from disturbance

Continuity of Supply.—To ensure continuity in the event of main pipe damage calls for a constant check up on the whole area at all times. Close contact with the mining engineers assists materially, as they are usually willing to make known the sections in operation and likely to cause surface damage. A weekly check of all water traps on the district main reveals any undue collection of water. Recording the quantity so extracted from each trap is a good guide to probable damage in the section covered by the trap, and enables one to take action before something more serious may occur.

Close contact with the other public utility service staffs, police on beat, telephone staff, and even vanmen is most desirable in getting assistance in the reporting of "smells of gas" in the area. Not least important is the constant urge to staff and employees to observe and report upon any evidence of damage to road surfaces, such as cracks, displaced kerb stones, fractured pavement slabs, cracks and rents in buildings, and service pipes where exposed showing signs of disturbance.

The linking up of main pipes to form circuits is essential, as the locus and nature of defect are not always readily detected, and circuit supply is valuable in reducing to a minimum the number of consumers affected in operations of testing or repair work.

Nature of Damage.—The nature and degree of damage to main pipes vary from disturbed joints to severe damage up to 100 yards in length. One cannot readily pre-determine the nature or degree of damage likely to occur in any given section, even when advised by the mining engineers. The damage may develop slowly, and require constant attention, and temporary repair spread over several months, and may end up with a definite localized smash, or it may develop quite suddenly without warning.

In one case a street with a rise of 1 in 40 suffered a draw by the fall-in of the waste workings as the coal face extended. The effect caused the ground surface to fall up the hill, drawing the joints at each end of the disturbance, and compressing the main pipe in the affected section to such an extent that it was shattered for 15 in. of its length to accommodate the compression. All the service pipes, which were of steel tube tapped into the main, were torn out.

In another street the "draw" of the workings affected the main pipe for 180 yards of its length, causing it to part from the service pipes, from a fracture to 18 in. in length.

These were repaired by inserting suitable short pieces, and as the coal face was worked through the area, the whole street and main pipe tilted back to approximately its original position, but at a slightly lower level. This happening again sheared all the service pipes in the opposite direction, and the work of repair had to be repeated. This main suffered so much damage that it had ultimately to be relaid.

Another case was that of a 3 in. steel high-pressure main laid in an ash covered footpath with two feet of cover. A section of this road had a rise of 1 in 50 with the long sleeve lead and yarn joints of the pipe facing up the rise. A sudden surface subsidence occurred and a telephone message stated that the gas main was up out of the ground with gas leakage and a whistling sound coming from it. Inspection confirmed this. What had happened was that the subsidence caused severe compression of the ground, and the long length of steel main in submitting to this compression pressure had no escape except upwards.

In so yielding the spigot of the pipe was forced downwards through the bottom part of the faucet of the lower joint, making a nice steel curl under the faucet. Temporary repairs were effected to maintain the supply of gas to the areas concerned by binding the defective faucet with a bag of puddle clay bound on by ropes. On cutting out the damaged joint, straightening the pipe and reinstating it by the use of a long sleeve collar it was found that we had a shorter main by 16 in.

Near the same place a little later a further "sit" took place at the bottom of the rise, when gas, water, and drainage pipes suffered, and the tramway rails, well bedded in concrete, had also to submit to the terrific pressure. They took a horizontal movement, which resulted in an acute double bend.

It does not necessarily follow that all surface damages occur when the coal is being removed. In the case of shallow seams the daily operations below ground are more pronounced on the surface as the coal-cutting machine makes its daily cut, and this followed by the "fall in" at the waste behind the coal face. As the seams deepen the time factor of surface damage is lengthened, and it is accepted practice to allow 1 year + 1 year for every 50 fathoms in depth for the subsidence to cease and the surface to become stabilized.

With several seams being operated at different points, stopping and starting from different approaches, and with a time lag up to three years to obtain stability, it cannot be said that such stability over the area ever matures. Then, of course, the smaller items of damage to pipes and services are no less a problem. There is no need to dwell upon these, as the drawn joint, burst faucet, torn and broken service pipes are common experience to most gas engineers.

Unaccounted-for Gas.—Loss of gas due directly to the operations of coal extraction may be classed under two headings:

(1) To sudden and serious main pipe damage, and
(2) to the slower and never-ending smaller disturbances.

In the case of the former, the actual loss of gas may be considerable while it lasts, but as the point or section of damage is immediately known, speedy isolation, and its repair, restricts the loss. The most serious form of loss is under the second head, and when one reckons up the number of joints, service connexions, the bends, tees, and elbows, on these services, the liability to clean fractures on main pipes at the point of greatest stress arising from the slow movement of the ground to and fro, there is no hope of securing speedy location or permanent repair. What is repaired to-day may be disturbed the next day. Under such conditions a distribution system is not unlike a pepper box, having thousands of minute and small leaks in more or less continuous operation.

As one cubic foot of gas loss per hour accounts for no less that 8,760 cu.ft. per year, the total loss assumes serious proportions. The sub-soil adjacent to mains and services is generally fouled with old as well as new leakages of gas, and this substantially rules out the use of the leak indicator or the spearing of the line of pipe. This factor often compels the need for exposing the complete section of pipe, and frequently when this has been done it calls for a decision on the spot to determine whether it is more prudent to renew the pipe or merely to repair it.

Financial Problems.—The renewal of main pipes in the normal is a procedure determined largely by their being overtaxed due to increased demand upon them rather than because of deficiency in the material structure of the pipe, particularly in the case of cast iron, which has a very long life. The renewal of service pipes in the normal is governed more so by the deterioration of the metal from internal and external corrosion where steel or wrought iron is used, to sagging in the case of lead services, and in each case to their being unable to cope with the peak hour demand. Such work is a normal part of many gas undertakings business. While a gas undertaking operating in a mining area has these normal renewals to deal with, it is burdened with the abnormal expenditure occasioned by damage due to underground working, over which no control exists. Comparison of expenditure on the repair, maintenance and renewal of pipes over many years with undertakings of similar size, not affected by mining operations, reflect that they spend only from £20–£30 for every £100 spent in a mining area.

The price of gas in a mining area has to carry this additional cost, as well as the cost of producing the extra volume of gas lost. This latter cost is not easily computed, because it involves not only the net cost of gas into the holder, but an additional proportion of capital charges of the works plant, and distribution charges including the running costs where compressors are used.

It may be suggested that some offset of these costs may be present in the lower costs of coal, due to being on the coalfields, but this is not quite so. There is a saving in railway carriage charges, but all coalfields do not possess first-class gas-making coals, and choice of coal is restricted. Then, due to the abundance of coal, the coke market is restricted, and unless plant process can control the production of coke, the surplus has to be disposed of at lower prices. Thus the cumulative effect of the additional costs upon the selling price of gas in a mining area is considerable, and has repercussions on the sales of gas.

(To be concluded)

* From a Paper to the Scottish Junior Gas Association (Eastern District), March 3.

COMPANY MEETING

British Gas Light Company

The 214th Ordinary General Meeting of the British Gas Light Company, Ltd., was held at the Chief Office of the Company, 2, The Abbey Garden, Westminster, S.W. 1, on Wednesday, Mar. 28, Mr. HENRY WOODALL, M.Inst.C.E. (Chairman and Managing Director), presiding.

The SECRETARY (Mr. A. J. Mumford) read the notice convening the meeting, together with the reports of the Auditors. The Directors' report and statement of accounts for the year ended Dec. 31, 1944, were taken as read.

The CHAIRMAN, moving the adoption of the report and accounts, said: This is our 214th General Meeting. In the earlier days general meetings were held half-yearly; the Company is 121 years old. As a result of the recent revocation of the Accounts (General) Direction and Order, 1942, we are, after a lapse of four years, once again able to submit to the meeting a statement of accounts and a report upon the results of the year's working, but we still need to be circumspect. The regulations affecting the use of paper still tie us, and account for the somewhat attenuated form of the printed statement which has been issued and is now before you.

Before dealing with the year actually under review it may be of interest to spend a few minutes in looking back over the past few years, and comparing our present position with what it was at the end of 1939. During the war years there has been a complete cessation of hire purchase sales of appliances, stocks—particularly of coals and apparatus—have been reduced and capital expenditure on mains has been almost entirely limited to extensions required to meet essential needs. The effect of this on our cash resources is reflected in the liquidation of the temporary loan from our bankers, which, at Dec. 31, 1939, stood at £137,000, an increase of £62,339 in the amount on current account and in hand, and the special investment of £70,000 in 3% Savings Bonds. In addition, we were during last year able to set aside, by the purchase of some £80,000 of tax reserve certificates, the sum required to discharge the income tax liability which became due on Jan. 1 this year.

The majority of our Subsidiary Companies have been similarly affected, and in consequence have made substantial payments in reduction of the temporary loans they have received from the Company, the total of which at Dec. 31 last was £121,800 lower than at Dec. 31, 1939. In this connexion, however, it should be explained that £40,000 of this reduction arose from the cancellation of part of the Gorleston Company's loan in 1940. As will be remembered, for some years before the war that Company had for various reasons been in very low water. Capital was high and sales were falling, and the Directors considered it was desirable that some measure of assistance should be given to the undertaking. They therefore decided to cancel part of the loan, and thus permit of the writing out of outstanding suspense accounts in the Gorleston Company's balance-sheet and a certain amount of fixed capital. The cancellation was made out of the reserve known as Profits on Realization of Assets and Sales of Land, &c.

The significance of the change-over of nearly £350,000 in the cash position is that it represents to a large extent money which, but for the effect of war conditions, would now be actually employed in our business, and is an indication of the brake on our activities resulting from the wartime restrictions. The General Reserve Fund (London), which now stands at £275,000, is up by £25,000 over the figure at December, 1939. The Station Reserve Funds are in aggregate £30,249 more, and the Profit and Loss balance is £6,746 less. Bringing in the Pension and Superannuation Funds, which are higher by £55,848, and allowing for the reduction of £40,000 in the reserve comprising Profits on Realization of Assets and Sales of Land, &c., mentioned above, there is a net increase of £64,351, and we have grounds for feeling satisfied and indeed thankful that we have been able to weather these past critical years without any weakening of our financial position.

In compliance with a notice served by the Ministry of Fuel and Power, application was made in 1944 for a Special Order in respect of the Thetford Station, the sales of gas at that station having increased to beyond 30 million cu.ft. a year. The Draft Order, which follows the form of Orders recently made in respect of Stations of the Company, is now before the Ministry, but it seems possible there will be some delay before it is actually made.

Turning to the accounts for the year to Dec. 31, 1944, it will be seen that after meeting all charges, paying the year's dividends on the Preference Stocks and an interim dividend of 3%, less income tax, on the Ordinary Stock, there remains sufficient to pay a final of 3%, less income tax, making 6% for the year, on the Ordinary Capital, and leave just over £1,000 to be added to the balance of profits carried forward. No addition has been made to the General Reserve Fund (London) this year, the amount of this Fund remaining at the substantial sum of £275,000, which is invested wholly outside the Company's business and almost entirely in gilt-edged securities. The aggregate of the Station Reserve Funds has been increased to £39,821 by the transfer to the Norwich Fund of profits earned in excess of the amount which the Parent Company is entitled to draw from the Station this year.

The sales of gas for the year at all our undertakings, including the Subsidiary Companies, amounted in total to practically 10% more than in 1943.

It will, I imagine, not come as a surprise to you to hear that the Company has not extended the scope of its activities during the past few years, but I may say that we have during the period proceeded with our plans for the closer grouping of certain of our undertakings, particularly in East Anglia, and consideration of schemes for further linking up, or physical integration as it is now called. As will be known, however, the Minister of Fuel and Power has set up a Committee under the Chairmanship of Mr. Geoffrey Heyworth with wide terms of reference, and it would seem highly probable that major schemes of development will have to be held in abeyance until that Committee has finished its investigations and its findings are made known. The Company, with its 121 years of experience in operating gas undertakings in various parts of the country, has an excellent record, and is, we claim, well equipped to continue the work it has successfully carried out over such a long period. I, for one, am satisfied that there is no inherent disadvantage in the central control of dispersed undertakings, as I know it can be fully maintained, and I know the advantages which accrue to the individual undertakings from common ownership. On the other hand, where it is possible to have a group centred on a large undertaking, as we have in the Norfolk district for instance, an even greater degree of co-ordination can be obtained.

The coal position causes us some anxiety, and the cost to our Company has risen by 66% as compared with 1939. There have been a number of additions to miners' wages, and I think I am right in saying that every such increase has resulted in a smaller production of coal. Another thing is that the coal we get now is in many cases not properly screened, and the quantity of ash and moisture is often very excessive. As has been said elsewhere, the Gas Industry is under a legal obligation to supply gas of declared standard calorific value, and the sale of the necessary raw material, coal, should be placed on a similar basis.

As to the future of our Industry there is no need for any despondency. One thing very necessary is that we should not be too much controlled by Government Departments. In war restrictions are necessary, and we accept them without complaint, but they do cause delay.

One of the tasks to which the Government has promised to afford the highest priority as soon as labour and materials are available is the provision of new houses to replace those which have been destroyed, and to provide accommodation for the many young people who will want to set up their own homes for the first time. The people who will occupy the new dwellings have earned the right, after living for more than five years under control and direction, to freedom of choice as to the form of lighting, heating and cooking services they will adopt, and it is essential that provision should be made for a supply of gas to every new house erected in a district where gas is available or likely to be available, so that the occupier may benefit from the amenities of "heat on tap" if he or she so desires. Moreover, in the construction of these houses, full provision for the use of gas appliances should be looked upon as an integral part of the building plan, and should not be left to be dealt with as an afterthought, with resultant additional expense, which will often fall upon the householder.

Such results as I have been able to report could only have been achieved by everybody in the service of the Company pulling his weight, and we are grateful for the good service which we have obtained. We cannot forget the 354 of our men serving with His Majesty's Forces; we constantly have them in our thoughts. Some of them have lost their lives, and our deep and sincere sympathy goes out to their relatives. The rest we hope soon to welcome home again.

The report and accounts were adopted, and the dividend resolutions as indicated in the Directors' report were carried unanimously.

The retiring Directors, Lieut.-Col. H. F. H. Jones and the Hon. Geoffrey C. Gibbs, were re-elected, and the Auditors, Messrs. Cash, Stone, & Company, were reappointed, Mr. WM. CASH, jun., briefly acknowledging this renewal of confidence.

Mr. K. R. MACKAY, proposing a vote of thanks to the Chairman and Directors for their able management of the business of the Company, congratulated them on the excellent balance sheet they had presented. The resolution was seconded by Mr. A. H. PART and carried unanimously.

The CHAIRMAN proposed a vote of thanks to the officers, staff, and workpeople of the Company, with whose help he said they had overcome difficulties which would have been thought almost impossible if they had known beforehand that they were going to happen. They had managed to keep going successfully, and they could never be grateful enough to their officers and men for all they had done. He hoped that later on they would be able to print a report on the courageous and fine way they had overcome very severe and difficult circumstances.

The DEPUTY-CHAIRMAN (Mr. Harold G. Palmer) seconded the resolution, which was carried unanimously.

The SECRETARY, acknowledging the vote on behalf of the staff, said he would be most pleased to convey the thanks of the meeting to the engineers and officers, and he knew they would be gratified that their efforts had been so much appreciated.

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The Hermit Crab is literally "a poor fish," and for all we know, he may be responsible for the coining of that well-known phrase. Apparently he has neither brains nor—to put it vulgarly—guts! Else how could he be content with somebody's discarded abode as his lodging? Nevertheless, this "discarded" abode becomes his only protection (and a very efficient one) against the rigours of the elements and against his natural enemies. And this brings us to the point of this short narration . . . you must have protection and that protection must be efficient. Obviously, then—

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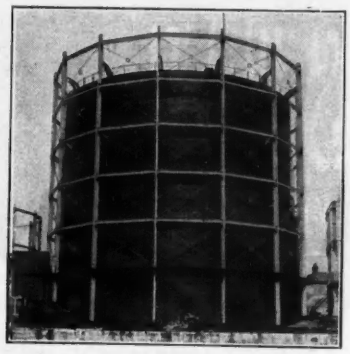

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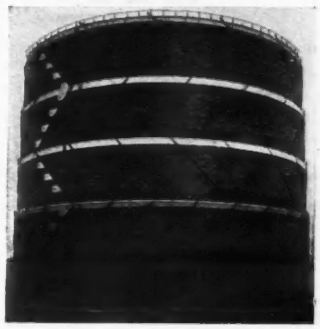

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GAS PRODUCTS PRICES

The London Market April 2.

As from March 5, by the Coal Tar Products Prices Order, 1945 (S. R. & O. 1945, No. 229), the maximum price of Pitch for briquetting has been increased to 60s. per ton f.o.r. supplying works, and the prices for Road Tar, as fixed by the Coal Tar Products Prices Order, 1943, S. R. & O. No. 1528, have been increased by one half-penny per gallon. There is also an increase of 5s. per ton in the price of standard Creosote/Pitch Mixture.

The prices of other products are unchanged.

Control of Benzole and Coal Spirit Order, 1944 (S.R. & O. 1944, No. 172), is in force.*

By this Order the price of Motor Benzole is fixed at 2s. per gallon. The Order also lays down the method of evaluating Crude Benzole, and calls for periodical returns to the Ministry of Fuel and Power from all producers of Crude and Refined Benzole.

Control of Toluene (No. 4) Order, 1944 (S. R. & O. 1944, No. 170), contains an amendment of the Control of Toluene (No. 3) Order, 1943.

There is also the Control of Benzole and Coal Spirit (No. 2) Order, 1944 (S. R. & O., No. 988).

Coal Tar Products Prices (No. 2) Order, 1944 (S. R. & O., 1944, No. 1051), allows increases in the maximum prices for all forms of Naphthalene.

* Slightly amended by Control of Benzole and Coal Spirit (No. 2) Order. 1944.

The Provinces April 2.

The average prices of gas-works products during the week were : Pitch and Crude Tar,* Toluole, naked, North, 90's, 2s. to 2s. 2½d., pure, 2s. 9d. (now controlled by S. R. & O. 1944, No. 988, operative from Sept. 1, 1944. Benzole and Coal Spirit, also Coal Tar Naphtha and Xylole, are now controlled by the Control of Benzole and Coal Spirit Order, 1944, dated Feb. 18, 1944, S. R. & O. 1944, No. 172, operative from March 1, and S. R. & O. 1944, No. 988, part 1, operative from Oct. 1, 1944, Carbolic acid, 60's, anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.), and strained anthracene oil controlled by the Coal Tar Products Prices Order, 1943, dated Oct. 20, 1943 (S. R. & O. 1943, No. 1528), operative from Nov. 15, 1943, Naphthalene now controlled under S. R. & O. 1944, No. 1051, operative from Sept. 22, 1944.

Attention is called to Coal Tar Products Prices Order, 1945 (S. R. & O. 1945, No. 229), referred to on p. 305, "JOURNAL" of March 7.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Scotland Mar. 31.

Export trade is still difficult, but home deliveries are well maintained. Refined tar*: Yield to Distillers is 5d. per gallon *ex* Works, naked. Creosote oil: Timber preserving quality,* 5½d. to 6½d.; hydrogenation oil,* 5⅞d.; low gravity or virgin oil,† 7¼d. to 7½d.; benzole absorbing oil,* 6½d. to 8d. per gallon. Refined cresylic acid* is 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha†: 6½d. to 7d. per gallon. Solvent naphtha*: Basic prices delivered in bulk, 90/160 grade, 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.; Rectified, 2s. 2d. per gallon. Pyridine†: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

* Price controlled. † Uncontrolled.

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GAS STOCKS AND SHARES

Stock markets were more active last week than for some time past despite the near approach to the Easter holiday and a brighter sentiment was in evidence. British Funds continued firm, but a set-back occurred in French bonds. Several good features were noticeable in the industrial section.

A heavier turnover was also recorded among gas stocks and shares and the general upward tendency of prices continued. Several further increases were made last week, the feature being a gain of 10 points in Oriental Stock to 159½; the last recorded transaction was in October last at 146½. Gas Light units also closed a shade higher.

Comparing the current prices shown in the lists below with those ruling on March 1, it will be seen that nearly 50 issues have risen in value on the month, and this steady upward movement has been a feature for some time past.

The following quotations changed last week:

PROVINCIAL EXCHANGE

Sheffield Ord.	149—151	+1½

OFFICIAL LIST

Bombay	43/—48/—	+—/6d.
Gas Light Units	23/6—24/6	+—/3d.
Ditto 3 p.c. Deb.	89—92	+½
Ditto 3½ p.c. Red. Deb. ...	97—100	—½
Imperial Continental Ord.	110½—113½	+1½
Oriental	157—162	+10
Primitiva Ord.	12/—14/—	+—/6d.
South-Eastern Gas Corporation Ord.	22/3—23/3	+—/3d.
Ditto 4½ p.c. Red. Cum. Pref. ...	21/9—22/9	+—/3d.
South Metropolitan Ord.	93—96	—1

SUPPLEMENTARY LIST

Bristol 4 p.c. New Deb.	100—103	+1

Quotations on the London and Provincial Stock Exchanges

OFFICIAL LIST

Issue. £	When ex-Dividend.	Dividends Interest. Amnt. or Rate% Prev. Hf. Yr. Actual.	Last Hf. Yr. Actual.	NAME.	Quotations Mar. 28
1,767,439	March 12	20/-	20/-	Alliance & Dublin Ord. ...	117—122
891,664	Oct. 23	6d.	6d.	Asscd. Gas & Water U'd'ts Ord.	23/—24/-
388,938	,,	7¼d.	7¼d.	Do. Deferred	23/6—24/6
500,000	March 12	2½	2½	Do. 4½ p.c. Red. Cum. Pref.	21/—22/-
535,545	,,	2	2	Do. 4 p.c. Red. Cum Pref.	20/—21/-
341,966	,,	2	2	Do. 4 p.c. Irred. Cum. Pref.	18/3—19/3
561,370	Feb. 19	70/-	70/-	Barnet Ord. 7 p.c.	159—164
300,000	Oct. 9	10½d.	8¾d.	Bombay, Ltd.	43/—48/-
690,407	Feb. 5	70/-	70/-	Bournemouth 7 p.c. max. ...	157—162
362,025	Dec. 11	2	2	Do. 4 p.c. Deb. ...	102—107
659,955	March 5	25/-	57/-	Brighton, &c., 5 p.c. Con. ...	106—111
865,000	Sept. 25	60/-	60/-	Brit. Gas Light Ord.	132—137
545,000	Dec. 18	2½	2½	Do. 5½ p.c. 'B' Cum. Pref.	110—115
120,000	,,	2	2	Do. 4 p.c. Red. Deb.	95—100
10,000	Oct. 30	4/6	9/-	Cape Town, Ltd., 4½ p.c. Cu. Pf.	5—6
626,860	Feb. 12	70/-	70/-	Cardiff Con. Ord.	122—127
24,500	Nov. 13	8¼d.	8¼d.	Colombo 7 p.c. Pref.	22/6—24/6
764,169	March 19	4.78d.	4.78d.	Colonial Gas Assn. Ltd. Ord. ..	16/6—18/6
400,000	,,	7.649d.	7.649d.	Do 8 p.c. Pref. ...	22/—24/-
1,748,090	July 22 '40	30/-	30/-	Commercial Ord.	63—68
620,000	Dec. 11	1½	1½	Do. 3 p.c. Deb.	72—77
286,344	Feb. 19	2½	2½	Do. 5 p.c. Deb.	110—115
807,560	,,	60/-	60/-	Croydon sliding scale	122—127
644,590	,,	50/-	50/-	Do. max. div.	106—109
620,385	Jan. 2	2½	2½	Do. 5 p.c. Perp. Deb. ...	123—128
179,500	Feb. 12	50/-	50/-	East Surrey 'B,' 5 p.c.	103—108
176,461	Dec. 27	2½	2½	Do. 5 p.c. Deb. (Irred.)...	124—129
239,135	Nov. 13	6d.	6d.	Gas Consolidation Ord. 'A' ...	22/6—23/6
250,000	,,	4½	4½	Do. Ord. 'B' ...	22/3—23/3
250,000	,,	2	2	Do. 4 p.c. Red. Cum. Pref.	18/6—20/6
19,101,877	Feb. 19	6d.	6d.	Gas Light & Coke Ord. ...	23/6—24/6ex
2,600,000	,,	35/-	35/-	Do. 3½ p.c. max.	81½—84½
4,477,106	,,	2	2	Do. 4 p.c. Con. Pref. ...	101½—104½
2,993,000	Jan. 8	1½	1½	Do. 3½ p.c. Red. Pref. ...	100—103
8,602,497	Nov. 27	1½	1½	Do. 3 p.c. Con. Deb. ...	89—92
3,642,770	,,	2½	2½	Do. 5 p.c. Red. Deb. ...	107½—110½
3,500,000	,,	2½	2½	Do. 4½ p.c. Red. Deb. ...	107½—110½
700,000	March 12	1¾	1¾	Do. 3½ Red. Deb. ...	97—100
5,600,000	May 13 '40	80/-	80/-	Imperial Continental Cap. ...	110½—113½
43,820	Jan. 29	1¾	1¾	Do. 3½ p.c. Red. Deb. ...	97—100
2,167,410	Feb. 12	50/-	60/-	Liverpool Ord.	126—129
231,978	,, 19	50/-	50/-	M.S. Utility 'C' Cons.	103—108
918,657	,,	2	2	4 p.c. Cons. Pref.	101—104
675,000	Nov. 13	‡40/-	‡40/-	Montevideo, Ltd.	88—91
300,000	Jan. 8	£4	£6	Oriental, Ltd.	157—162
368,537	Dec. 11	57/6	50/-	Plymouth & Stonehouse 5 p.c.	113—118
621,667	Feb. 5	72/6	72/6	Portsmouth & Gosport Cons.	145—150
2,381,363	May 15	†9½d.	†9½d.	Primitiva Holdings, Ltd. Ord.	12/—14/-
233,900	Dec. 11	3	3	Do. 6½ p.c. Red. Cum. Pref.	99—104
648,999	Sept. 11	6½	6½	Severn Val. Gas Cor. Ld. Ord.	23/—24/-
597,972	March 12	2½	2½	Do. 4½ p.c. Cum. Pref. ...	21/6—22/6
2,528,714	Aug. 21	6d.	3½d.	South East'n Gas Cn. Ld. Ord.	22/3—23/3
1,000,000	Feb. 26	2½	2½	Do. 4½ p.c. Red. Cum. Pref.	21/9—22/9
1,068,869	,,	2	2	Do. 4 p.c. Irred. Cum. Pref.	20/—21/-
6,709,895	Feb. 12	†20/-	†40/-	South Met. Ord.	93—96
1,135,812	,,	3	3	Do. 6 p.c. Irred. Pref. ...	127—132
850,000	,,	2	2	Do. 4 p.c. Irred. Pref. ...	101—104
1,895,445	Jan. 2	1½	1½	Do. 3 p.c. Perp. Deb. ...	85—89
1,000,000	,, 15	2½	2½	Do. 5 p.c. Red. Deb. ...	103—108
1,543,795	Feb. 5	50/-	50/-	South Suburban Ord. 5 p.c ...	115—120
512,825	,,	2½	2½	Do. 5 p.c. Perp. Pref. ...	113—118
500,000	,,	2	2	Do. 4 p.c. Perp. Pref. ...	98—103
250,000	,,	1¾	1¾	Do. 3½ p.c. Red. Pref. ...	93—98
888,587	Dec. 11	2½	2½	Do. 5 p.c. Perp. Deb. ...	123—128
750,541	Feb. 5	50/-	50/-	Southampton Ord.	105—110
350,000	,, 12	2½	2½	Swansea 5½ p.c. Red. Pref.	105—110
1,076,495	,, 26	50/-	50/-	Tottenham & District Ord. ...	119—124
338,555	,,	2½	2½	Do. 5 p.c. Pref.	113—118
453,380	Dec. 11	2	2	Do. 4 p.c. Perp. Deb. ...	100—105
1,247,505	Nov. 6	7¼d.	6d.	U. Kingdom Gas Cor. Ord. ...	23/3—24/3
1,085,952	,, 13	5¾d.	5¾d.	Do. 4½ p.c. 1st Cum. Pref.	23/—24/-
772,709	,, 13	4¾d.	4¾d.	Do. 4 p.c. 1st Red. Cum.Pref.	19/—21/-
745,263	Dec. 18	5¾d.	5¾d.	Do. 4½ p.c. 2nd Non.Cum. Pf.	20/—21/-
1,200,000	Sept. 18	1¾	1¾	Do. 3½ p.c. Red. Deb. ...	98—103
380,606	Aug. 14	66/3	66/3	Uxbridge, &c., 5 p.c.	123—128
1,371,138	Feb. 12	50/-	50/-	Wandsworth Consolidated ...	122—127
2,525,768	,,	2	2	Do. 4 p.c. Pref.	101—104
1,343,964	Dec. 18	2½	2½	Do. 5 p.c. Deb.	128—133
383,745	,,	2	2	Do. 4 p.c. Deb.	100—105
558,342	Feb. 12	50/-	50/-	Watford & St. Albans Ord. ...	120—125

SUPPLEMENTARY LIST

Issue £	When ex-Dividend.	Dividends Interest. Amnt. or Rate% Prev. Hf. Yr. Actual.	Last Hf. Yr. Actual.	NAME.	Quotations Mar. 28
351,685	Dec. 18	2½	2½	Brighton, &c., 5 p.c. Perp. Deb.	122—127
415,250	,,	2	2	Bristol Gas Co., 4 p.c. New Deb.	100—103
140,205	Feb. 12	70/-	70/-	Cambridge, &c., 7 p.c. Cons. 'B'	140—145
295,932	March 12	50/-	50/-	Cheltenham, 5 p.c. Cons. Ord....	103—108
42,500	Dec. 18	2	2	Do. 4 p.c. Perp. Deb....	98—103
150,000	Feb. 19	2	2	Croydon Gas, 4 p.c. Pref. (Irr.)	98—103
130,000	Jan. 2	2	2	Do. 4 p.c. Deb. ...	100—105
53,220	Feb. 12	3	3	East Surrey, 6 p.c. Cum. Pref....	120—125
...	Aug. 19 '40	40/-	40/-	Eastbourne, 'B' 3½ p.c....	97—102
117,425	March 1	—	£6	East Wight Cons. 5 p.c. ...	100—105
25,000	Dec. 18	2½	2½	Guildford 4½ p.c. Red. Deb. ...	100—105
156,600	Feb. 19	50/-	50/-	Hampton C't, 5 p.c. Cons. Ord.	100—105
18,000	Dec. 29 '41	3½	3½	Malta & Med'n., 7 p.c. 1st Pref.	47—52
10,845	June 30 '41	37/6	37/6	Do. 7½ p.c. 2nd Pref.	47—52
50,000	Feb. 19	52/3	52/3	Mid. South. Util., 'A' Cons. 5 p.c.	105—110
70,380	Dec. 18	2½	2½	Newport (Mon.), 5 p.c. Deb...	115—120
65,000	Aug. 14	2½	2½	North Middlesex, 5 p.c. Pref....	110—115
70,000	March 12	2½	2½	Plymouth & Stone., 5 p.c. Deb.	120—125
76,501	Dec. 18	2	2	Reading, 4 p.c. Perp. Deb. ...	97—102
74,777	Oct. 2	2	2	Romford, 4 p.c. Debs. (Reg.) ...	97—102
21,000	Dec. 4	2½	2½	Slough, 5 p.c. Perp. Deb. ...	122—127
211,740	,, 11	2½	2½	Southampton, 5 p.c. Red. Deb.	105—110
363,575	Jan. 2	2½	2½	Tottenham, 5 p.c. Reg. Red. Mt.	98—102
202,019	Aug. 14	75/-	75/-	Tunbridge Wells, 4 p.c. Scale ...	125—130
135,257	Dec. 4	2½	2½	Uxbridge &c., 5 p.c. Perp. Deb.	123—128

PROVINCIAL EXCHANGES

					Quotations Mar. 23
804,948	July 31	2½	2½	Bath Cons.	114—116
122,577	Feb. 19	2½	4½	Blyth 5 p.c. Ord.	117½—118½
1,667,250	,, 12	2½	2½	Bristol, 5 p.c. max.	119—120
120,420	Dec. 18	2	2	Do. 1st 4 p.c. Deb	101—103
415,250	,,	2	2	Do. 2nd 4 p.c. Deb. ...	100½—102½
3,28,790	,,	2½	2½	Do. 5 p.c. Deb.	121—123
157,150	Feb. 12	3½	3½	Chester 5 p.c. Ord.	112½—116½
52,500	Dec. 18	2	2	Do. 4 p.c. Cum. Pref. ...	99—101
40,000	,,	2	2	Do. 4 p.c. Non. Cum. Pref.	99—101
36,430	,,	1¾	1¾	Do. 3½ p.c. Deb.	88—92
41,890	,,	2	2	Do. 4 p.c. Red. Deb. ...	100—102
542,270	Feb. 14	3	4½	Derby Cons.	130—135
55,000	June 12	2	2	Do. 4 p.c. Deb.	97—102
40,000	Feb. 19	5½	5½	Exeter 10 p.c.	185—195
10,000	,,	5	5	Great Grimsby 'A' Ord. ...	160—170
6,500	,,	5	5	Do. 'B' Ord.	160—170
79,000	,,	5	5	Do. 'C' Ord.	150—160
732,000	Feb. 19	2	2	Hartlepool G. & W. Cn. & New	92—94
490,681	Dec. 18	1¾	1¾	Liverpool 3½ p.c. Red. Deb. Stk.	95—100
245,500	,,	2	2	Do. 4 p.c. Red. Deb. Stk.	102—103
306,083	June 26	2	2	Do. 4 p.c. Deb.	103—105
680,000	Dec. 18	2½	2½	Do. 5 p.c. Red. Stk. ...	104—109
20,000	,,	2½	2½	Long Eaton 5 p.c. Pref.	9—11
80,000	,,	2½	2½	Do. 5 p.c. Deb.	117—122
2,430,267	Feb. 12	6d.	6.9d.	Newcastle and Gateshead Con.	26/3—26/9
682,856	,,	2	2	Do. 4 p.c. Pref.	102½—104½
776,706	Dec. 27	1¾	1¾	Do 3½ p.c. Deb.	99—101
250,000	,,	1¾	1¾	Do. 3½ p.c. Red. Deb. ...	97½—99½
73,186	Oct. 30	2	2	Do. 4 p.c. Red. Deb. ...	102—104
106,280	Feb. 15	5	5	Preston 'A' 10 p.c.	170—175
188,219	,,	3½	3½	Do. 'B' 7 p.c.	132—135
1,806,339	Feb. 25	3½	3½	Sheffield Cons.	1 9—151
95,000	Jan. 2	2	2	Do. 4 p.c. Deb.	98—102
332,351	Feb. 5	3	3	Sunderland 6 p.c. max. ...	121—123
192,150	,, 12	2½	2½	Weston-super-Mare Cons. ...	111—113
64,338	Jan. 2	2	2	Do. 4 p.c. Deb.	99—101
33,340	,,	3½	3½	Do. 7½ p.c. Deb.	145—150

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R. WOODWARD, Secretary and Manager.

COMPANY NOTICES

HORNSEY GAS COMPANY

NOTICE IS HEREBY GIVEN that the ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at Gas Industry House, 1, Grosvenor Place, London, S.W. 1, at 3 p.m. on the 26th April, 1945, to declare Dividends for the half-year ended 31st December, 1944; to elect two Directors; to appoint an Auditor, and to transact the ordinary business of the Company.
The TRANSFER BOOKS WILL BE CLOSED from 13th to 26th April, 1945, both days inclusive.
Gas-Works, Hornsey, N. 8. April 4, 1945.
By Order of the Board, K. LESLIE MORTIMORE, General Manager and Secretary.

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Tenders, enclosed in plain sealed envelopes, and endorsed "Tender for Gas Mains," should be delivered to the undersigned not later than Tuesday, April 17, 1945.
The Council do not bind themselves to accept the lowest or any Tender.
Town Hall, Cleckheaton. March 27, 1945.
D. COUPE, Clerk of the Council.

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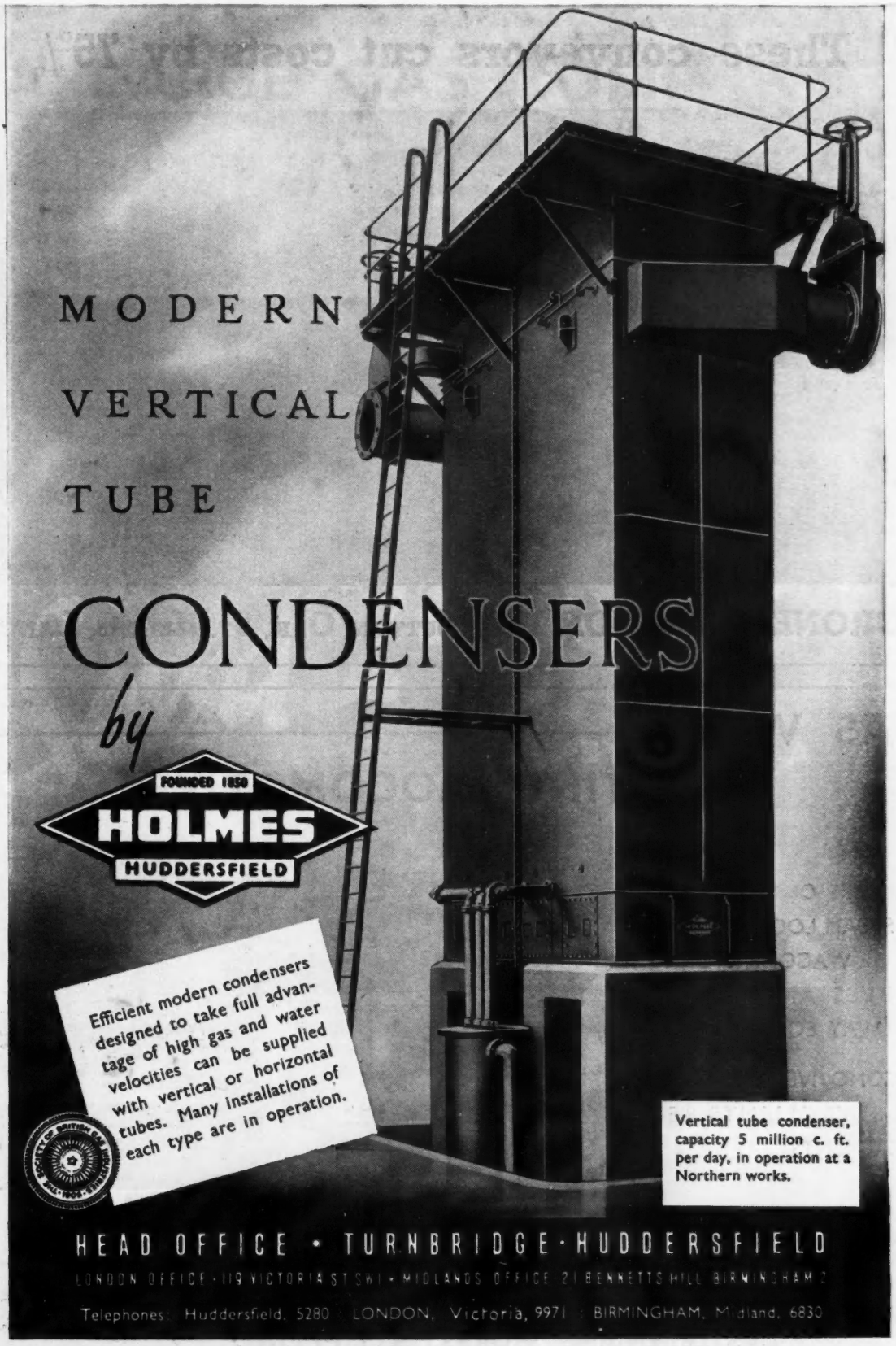
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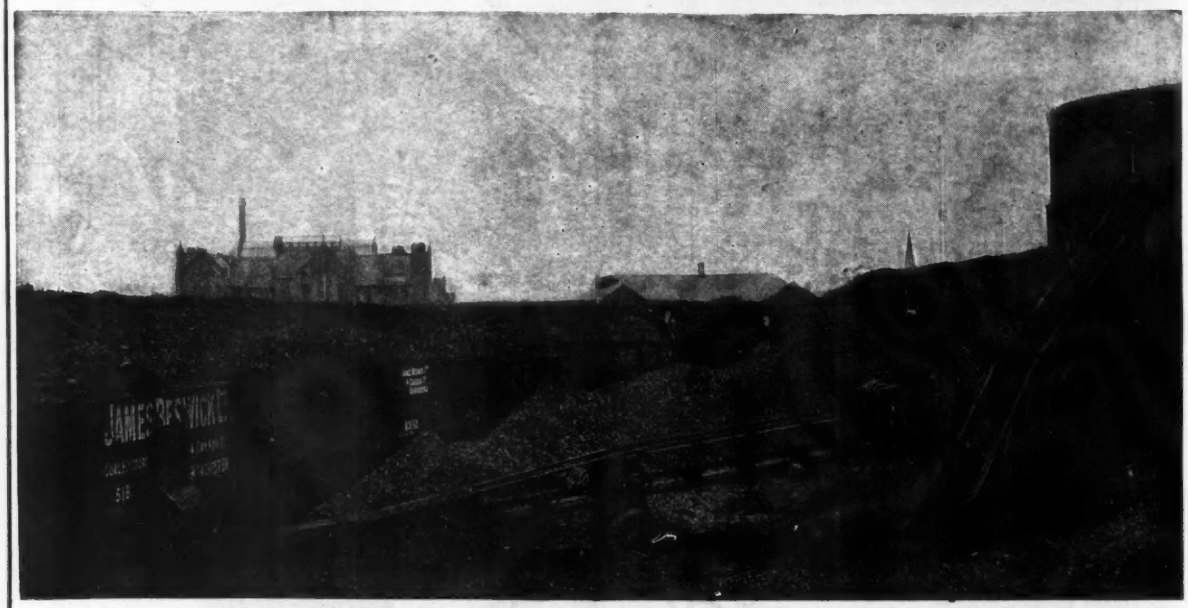

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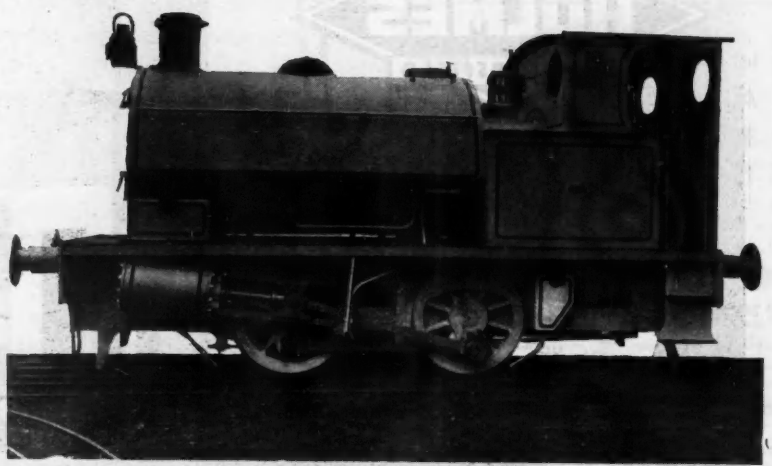

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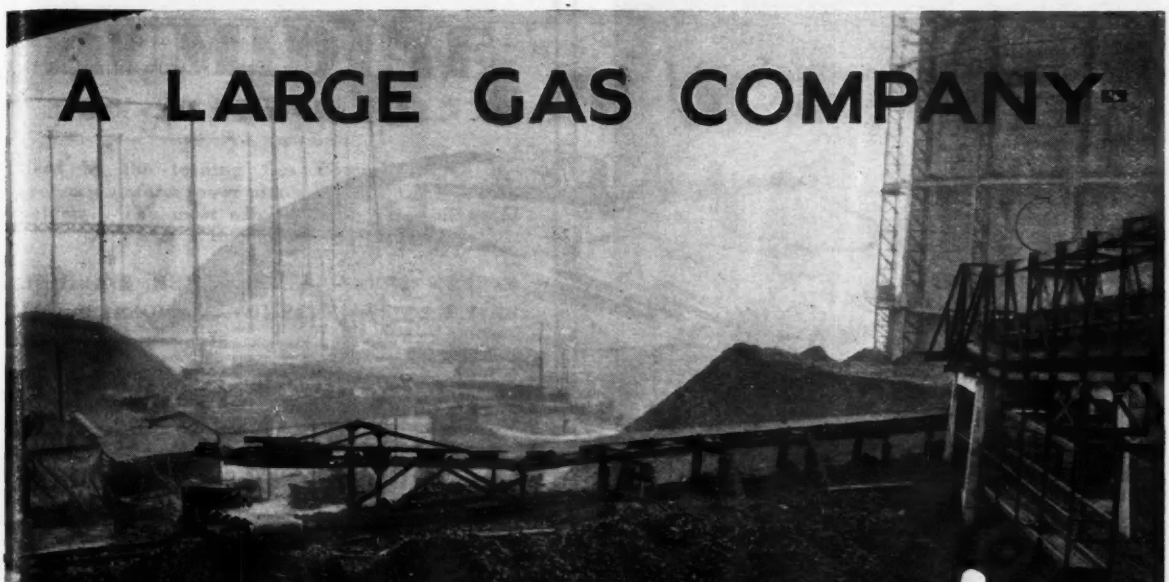

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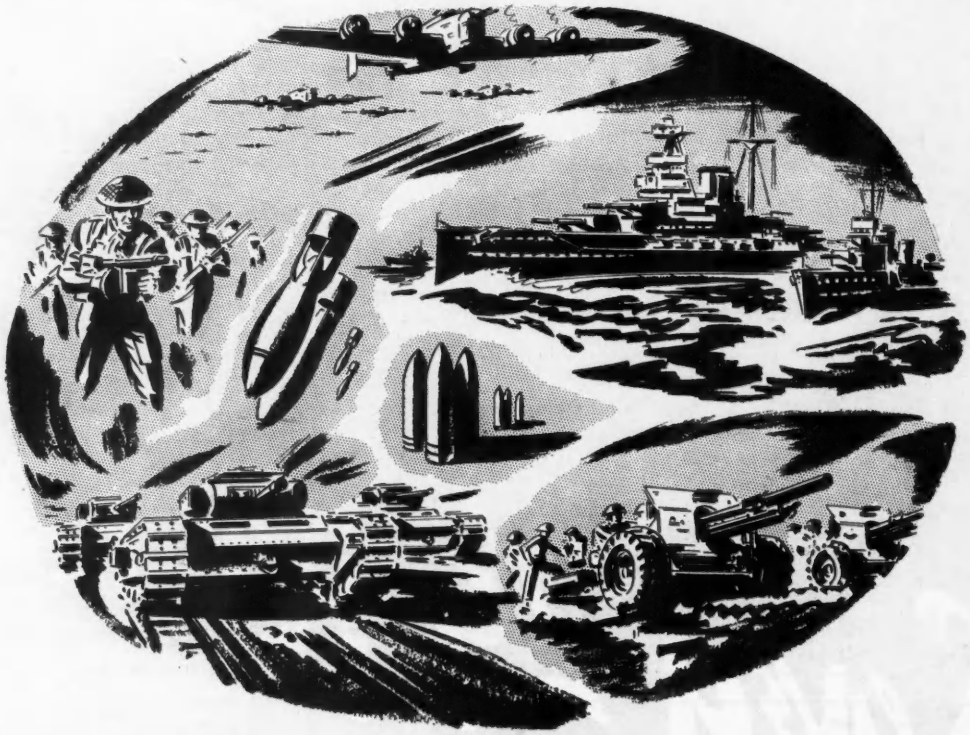

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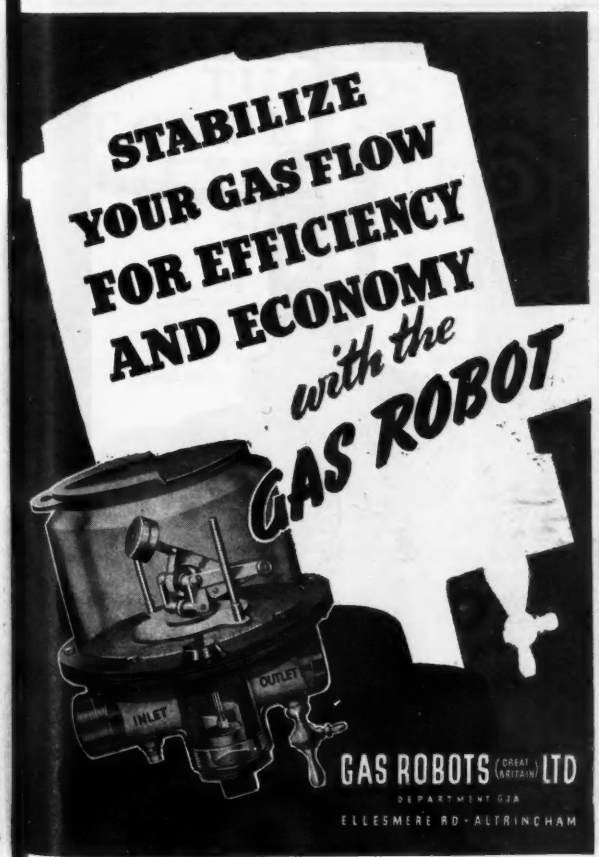

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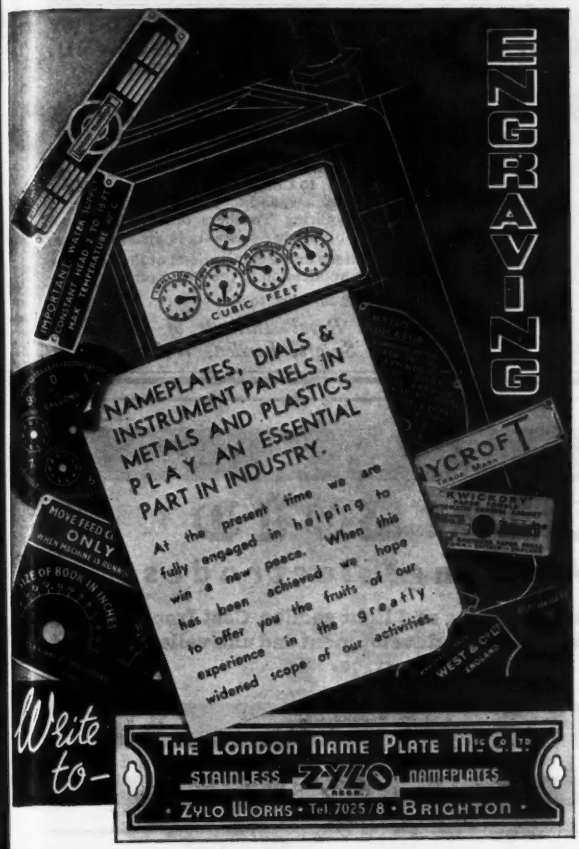
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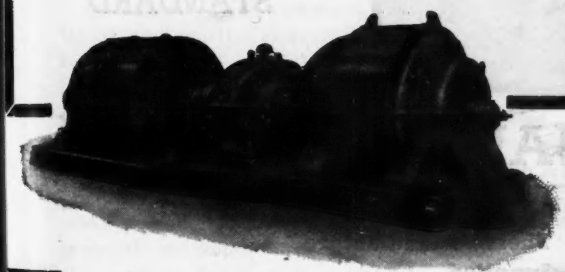

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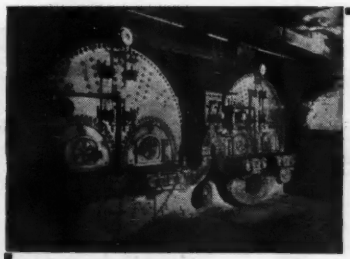

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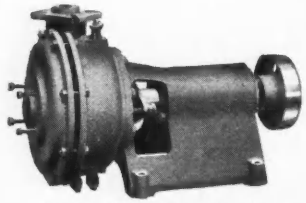

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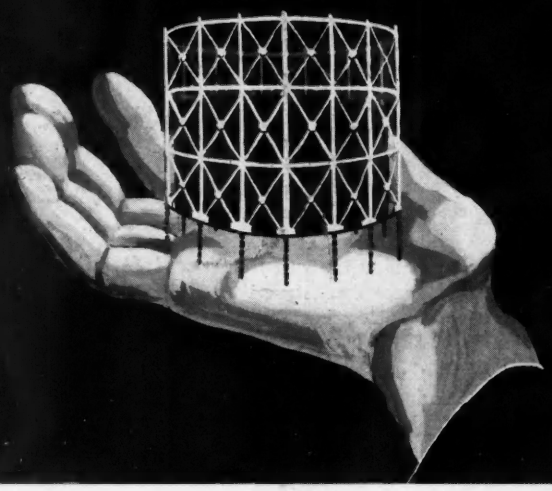

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